EFFECT OF MUSIC THERAPY ON THE OXIDATIVE STRESS AND HORMONAL MARKERS OF BREASTMILK SECRETION IN PRIMIGRAVIDA MOTHERS AFTER NORMAL DELIVERY: A RANDOMISED CONTROLLED TRIAL

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LIST OF ABBREVIATIONS

BP	Blood pressure
EB	Exclusive Breastfeeding
GIM	Guided Imagery and Music
HPA	Hypothalamic -Pituitary- Adrenal Axis
HR	Heart rate
MBFES	Maternal Breastfeeding evaluation scale
MDA	Malondialdehyde
MT	Music Therapy
NMT	Neurological music therapy
OT	Oxytocin
PRL	Prolactin
PSS	Perceived stress scale
RNS	Reactive nitrogen species
ROS	Reactive Oxygen species
TBARS	Thiobarbituric acid reactive substances
TRH	Thyrotropin-releasing hormone
UNICEF	United Nations Children's Fund
WHO	World Health Organization
MAP	Mean Arterial Pressure
GIM	Guided imagery and Music
DMI	Directed Music Imagery

ABSTRACT

Background: Music therapy utilizes musical interventions to assist people in achieving therapeutic goals and requires a trained music therapist, whereas music medicine does not require the therapist often. In recent years, these forms of non-invasive intervention have been gaining importance in evidence-based medicine, with reference to the alleviation of stress and anxiety, besides its role in conferring wellness on the clients. Music interventions are used in the clinical departments including obstetrics and gynecology. However, very few reports from India are available pertaining to the effect of music on breastfeeding, with reference to the extracellular status of oxytocin, prolactin, and markers of oxidative stress. Moreover, a unique approach was enabled in our study, namely the use of Indian classical music, in association with imagery that has hitherto been not attempted by several research workers.

Methods: The study subjects were primigravida (19-35years). Two groups, each having n=30 allocated into Music intervention (Group A) and Control (Group B) respectively. Six Indian Classical *ragas* or musical modes were selected, based on objective criteria, and made available as the choices for the study subjects to choose from. Six sessions were administered to Group A subjects in the hospital setting by the principal investigator, during the 72-hour period, post-partum and blood samples were collected from the subjects for quantitating oxytocin, prolactin and malondialdehyde (marker of oxidative stress). The subjects in Group A were then made to listen to the same *ragas* chosen*,* through a home-based intervention and asked to visit the clinics after 45 days. The Maternal breastfeeding Evaluation Scale (MBFES) was administered to elicit the perception of the mother on her breastfeeding experience after four days following delivery and forty-five days respectively. UNICEF checklist was also deployed in the study during their stay in the hospital. The study began only after obtaining the written approval of the duly constituted Institute Ethics Committee.

Results: The results revealed pronounced statistical significance between the intervention and control groups, with reference to oxytocin, prolactin, and marker of oxidative stress ($p < 0.05$). The results pertaining to the MBFES with the subsequent three subscales on mother's breastfeeding experience and baby's growth also exhibited statistical significance ($p<0.05$) when compared in the light of the two groups and as a function of the status of oxytocin, prolactin and marker of oxidative stress. Similarly, the physiological parameters, namely systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate also exhibited statistically significant regulated scores while comparing the two groups ($P<0.05$).

Conclusion: Music intervention based on Indian musical modes or *ragas,* chosen on the basis of objective criteria exerted a positive impact on the hormones related to breastmilk secretion, namely oxytocin and prolactin, besides alleviating oxidative stress and enhancing the mother's breastfeeding experience and promoting baby's growth.

CHAPTER 1

General Introduction, Need for the Present Study and Scope of the Investigation, Based on a Unique Approach

Lactation is a natural process of milk secretion considered essential not only for the nutrition of the baby but also for the sustenance of the social interactions that the infant experiences in the postnatal period. There is evidence that exclusive breastfeeding for six months, as prescribed by the WHO,[1] protects the infant from infections including diarrhoea and pneumonia, besides improving cognition and brain development. This is attributed to the vital nutrients and minerals inherent in the breastmilk.[2] Lactogenesis occurs in two stages, namely Stage 1 and Stage 2. [3]

Oxytocin (OT) and prolactin (PRL) are two major endocrine secretions in milk ejection and maintenance of breast milk secretion. [4] OT is a nonapeptide comprising nine amino acid residues associated with labor, and the ejection of milk is enabled with the suckling of the baby and has been found to reduce cortisol, thereby indicating the alleviation of stress and bringing down the negative emotional state. [5-7] PRL promotes mammary gland development, which is termed mammogenesis, synthesis of milk(lactogenesis), and maintenance of milk secretion, referred to as galactopoiesis. [8] Milk proteins during breast milk synthesis are primarily regulated by PRL, while growth hormone, insulin and cortisol modulate the process. [9] Dopamine is said to inhibit the flow of PRL.[10] The daily secretion of PRL depends on the duration and frequency of suckling by the infant.[11,12]

Stressors of lactation

Lactation is regulated by physical and psychological stress surrounding pregnancy and parturition that includes a wide array of factors, namely mode of delivery, duration of labor, labor medication administered, and inability to suckle by the infant. All these could lead to suboptimal lactogenesis. [13,14, 15-17] The confidence level of the mother plays a cardinal role in promoting successful breastfeeding practice, whereas stressors synonymous with sore nipples, breast engorgement, and complementary foods would cast a negative impact on exclusive breastfeeding practices. [18,19]

Oxidative stress

Physical stress experienced by the mother while going through the process of delivery is associated with oxidative stress, which is defined as an imbalance between pro- and antioxidant capacity. [20-22] The brain's high oxygen consumption and a lipid-rich environment point to an enhanced susceptibility to oxidative stress or redox aberrations.[23] At term, oxidative stress is linked to the placental membrane disruption that coincides with the onset of labor and is thus believed to possess an impact on the child. [24,25]

Therapeutic effects of Music and its underlying mechanism

Music intervention could relieve the anxiety and attenuate the stress response in an individual by modulating the sympathetic nervous system. This results in altered emotions. [26,27] The hypothalamic-pituitary-adrenal (HPA) axis is regarded as a system that assists the body in facilitating adaptation to challenges by regulating energy resources. [28,29] Music-induced activities are associated with the endocrine system through the cortical and subcortical neural networks that possess a nexus with the emotional processing of music. The HPA axis is controlled by the prefrontal cortex and the ventral hippocampus, which inhibits the HPA axis. In obstetrics and gynecology, there is unequivocal evidence to portray the effect that music helps to alleviate pain and/or pain perception during labor, besides improving cooperation levels. Evidence also cites the effect of music in improving lactation and bonding between mother and child. [14,30-35]

Need for the present study:

Based on the available literature in the realms of music as a wellness and therapeutic modality, it is evident that studies, especially from South India, evaluating the utility of music on oxidative stress and PRL with respect to breast milk secretion are sparse. In addition, hitherto only a few studies have been made available that denote the changes in the status of OT with music as the preferred or chosen intervention.

Scope of the investigation, based on a unique approach

The study was a randomized controlled trial, essentially aimed at the evaluation of the effects of music therapy on the status/levels of OT, PRL, and

oxidative stress, but with reference to milk secretion in primigravida mothers, following a normal vaginal delivery. The maternal perception of breast milk secretion and breastfeeding satisfaction levels were also figured in the endeavor.

The Bonny Method of Guided Imagery and Music (GIM) is aptly described as a music-centered approach for exploring consciousness for the purpose of enabling personal growth and transformation. Several clinical and nonclinical contexts bear testimony to this fact. [36] GIM could assist the clients experiencing psychological and emotional difficulties, wherein verbal counseling of psychotherapy would prove to be an alternative therapeutic modality when used in conjunction with music. Basically, the method centers around the client imaging monitored by the concurrent classical music listening experience. Classical music (Western) is being used in the conventional Bonny method of GIM.

However, for the first time in this part of the country and from the portals of a tertiary health care set up in modern medicine housing an exclusive institute committed to salutogenesis or wellness, we have attempted the study, wherein one of the study components essentially refers to the utility and efficacy of Directed Music Imagery(DMI) with Indian classical music (a version adapted from the GIM but aligned with the Indian Classical Music) as a non-invasive tool in complementary medicine. A unique aspect of the study is the use of Indian Classical music-based modes termed *raga(s)* along with imagery, hitherto a less explored facet of music, as a non-invasive modality for wellness and therapy. The word *"raga"* (singular) has originated from the ancient Indian language, namely Sanskrit and essentially denotes "one that paints or colors your mind**"**

CHAPTER 2

Aim and Objectives, Research Question

Aim:

To study the effect of music as a non-invasive intervention on the degree of objective markers of oxidative stress and extracellular status of hormonal markers of breastmilk secretion in primigravida mothers, following normal delivery as well as the maternal perception of breastfeeding quality and satisfaction.

Objective One:

To compare the changes in levels of oxytocin, prolactin and the oxidative stress marker, namely lipid peroxidation, between the music therapy group (Group A) and control group (Group B)

Objective Two:

To compare the changes in levels of oxytocin, prolactin and the oxidative stress marker-lipid peroxidation within the music therapy group (Group A)

Objective Three:

To compare the maternal breastfeeding satisfaction of the mothers between music therapy group (Group A) and control group (Group B) at the end of the 45-day period, following delivery and after the home-*based music listening experience.*

Objective Four:

To compare the perception of breastfeed and comfort levels of breastfeeding between the music therapy group (Group A) and control group (Group B)

Objective Five:

To compare the physiological and biochemical parameters and hematological indices in breast milk secretion, between the music therapy group (Group A) and control group (Group B)

Research Question

Can intervention through music therapy impact the levels of oxytocin, prolactin, and influence breast milk secretion in mothers, with reference to the attenuation of oxidative stress and enhancement of the mother's breastfeeding experience and baby's growth, following normal delivery?

CHAPTER 3

Review of Literature

Breastfeeding provides an ideal food for the healthy growth and development of infants, while it confers positive effects on the health of the mother. [37] A survey had indicated that out of 81.1% of babies delivered in hospitals, only 44.1% received breastfeeding within the first hour of delivery. [38] The World Health Organization (WHO) and the United Nations Children Fund (UNICEF) recommends that the initiation of breastfeeding must essentially be enabled within one hour of delivery, and six months of exclusive breast milk with continued breastfeeding for a minimum period of two years in association with complementary and healthy foods are recommended. [39]

The practice of breastfeeding or the process of lactation/breast milk secretion following delivery might be affected by stress, attributable to the physical and psychological factors during pregnancy and delivery. [14, 15, 40.] Oxytocin (OT) and prolactin (PRL), the peptide hormones, release once the infant starts to suckle. OT is normally said to be associated with labor and ejection of milk; [5] PRL is necessary for the initiation and maintenance of breastmilk. In addition to this, the mother's brain undergoes experiential changes that can be attributed chiefly to the endocrine system, and the brain is regulated according to the changes for the purpose of facilitating and preparing the mother for pregnancy and lactation. [41]

Oxytocin and its mechanism on lactation

OT, a neuropeptide comprising nine amino acid residues, is synthesized centrally in the hypothalamus, mainly through the paraventricular nucleus and also by the supraoptic nucleus and gets released into the bloodstream through the neurohypophysis (posterior pituitary) during a variety of conditions, including labor, lactation, uterine dilatation, stress, sexual stimulation, and during social interactions. [42,43] OT is not only a peptide but also a neurotransmitter that gets released during labor and breastfeeding. [44-47] The breast milk is expressed through the characteristic *milk ejection*, a reflex brought about by a neuroendocrine mechanism that culminates in the release of OT from the pituitary gland, and this is linked to the

interaction with myoepithelial cells that surround the ducts and alveoli. [3] The structure of OT is depicted in Fig.1.

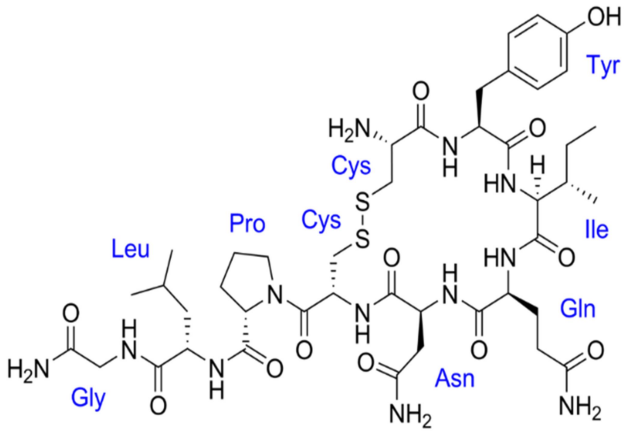


Fig 1. Structure of Oxytocin

Stress is said to elicit an adverse effect on the release of OT. As early as in 1948, it was reported that milk letdown/ejection is a reflex secondary to suckling the breasts, which is an internal process, but can also be affected by external stimuli. [48] In a study, it was ascertained that anxiety and depression lower OT levels in mothers following delivery. [49] OT works on the psychological aspects of the mother and child following birth, pointing to improved bonding. [40] When the mother is calm and stress-free, oxytocin flows optimally. [50] This is an essential facet to be taken into due consideration while devising music as a prospective tool of wellness.

Role of prolactin in lactation

PRL increases towards the end of pregnancy and remains high even following delivery for a period of six weeks. [51] It collaborates with the immune-neuroendocrine network, where immune, nervous, and endocrine systems indulge in molecular conversation. [52] Several factors, including pregnancy, suckling, Thyrotropin -releasing hormone (TRH), stress, etc. influence PRL secretion. [53] TRH stimulates PRL while dopamine is an inhibitor of secretion. PRL found in lactating mother's milk originates from the anterior pituitary gland and is ejected through the mammary glands.[54] The flow of PRL is inhibited by estrogen and progesterone, and hence, as soon as the placenta is expelled, following delivery it is released with the baby's suckling act being the driving force. [55]

PRL is mainly inhibited at the level of the hypothalamus. [56] Dopamine, a catecholamine neurotransmitter, is said to be the main inhibitor of PRL release.[57] It is well known that the reduction of dopamine results in the secretion of PRL. [58–60] PRL secretion is regulated in more than one manner. [57-61] While suckling remains a stimulus by itself for the secretion of PRL, it is also found that the circadian rhythm of light and darkness could regulate secretion which might cause a profound impact on lactation in nursing mothers.[62,63] The role of PRL in human reproduction is depicted in Fig.2.

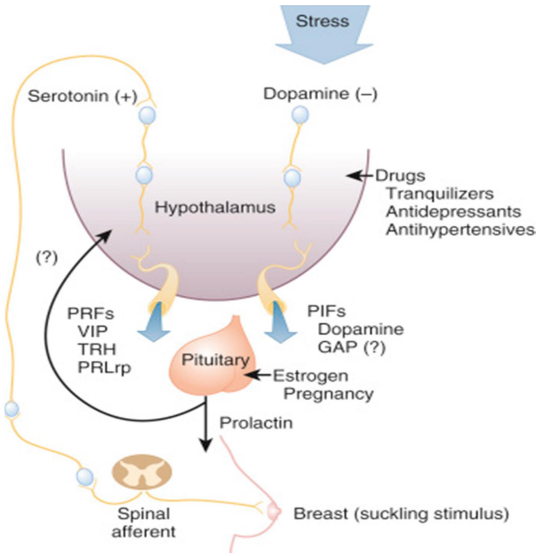


Fig 2. Prolactin and its role in human reproduction.[64]

Oxidative Stress and its impact on labor

The process of normal vaginal delivery might enhance oxidative stress. [65,66] Oxidative stress increases during pregnancy, and it induces lipid peroxidation, besides inhibiting antioxidant enzymes. Malondialdehyde (MDA) is one of the most frequently investigated biomarkers of oxidative stress, notably lipid peroxidation. [67] During the physiological process of parturition, there is an exaggerated production of free radicals. Free radicals are highly reactive chemical species that are endowed with a lone electron in the outer orbital, by virtue of which they acquire reactivity eventually resulting in oxidative stress to the mother and infant. [68,71] This has been found to impact the baby in the infant stage, synonymous with a longitudinal effect comprising of neurodevelopmental disorders, ischemic heart disease, pulmonary

complications, insulin resistance, hypertension, stroke,[25] and brain damage in preterm newborns. [72] Breast milk possesses antioxidant properties. [69,73-75]

Breastfeeding and Maternal Perception of Breast Milk Secretion

Exclusive breastfeeding (EB) for six months alleviates gastrointestinal and respiratory problems, besides assisting the infant to overcome poor linear growth and cognitive impairment. [76] EB is safe, cost-effective, and recommended for the first six months of a baby's life. EB has also been recorded to prevent mortality to the extent of 11.4% in babies under 24 months, according to WHO/UNICEF data released in 2012. Babies when left with the mothers within the first half an hour of birth provide a space for infant-maternal bonding, associated with prolonged breastfeeding periods, and also render help to establish early lactation. [77.78] Breastfeeding failures worldwide are linked to altered confidence in maternal perception of sufficient breast milk, termed perceived insufficient milk (PIM). [79-82]

Music and Music Therapy

The fact that music could act as a vector to express emotions and hence forms the basis for music therapy. In the words of Bruscia, music therapy (MT) is regarded as "*a systematic process of intervention wherein the therapist helps the client to promote health, using musical experiences and the relationships that develop through them as dynamic forces"* MT is considered an evidence-based use of music interventions to work through well-defined goals within a therapeutic relationship by a professional music therapist and duly certified by a music therapy program. [83, 84]

MT has been found to regulate vital signs, and the assessment and evaluation of the neurological response to music reveals changes in several facets, including endocrine chemistry. [85] Studies have documented the utility of choir music, imagery and relaxing music in conferring benefits on the hypothalamic-pituitary-adrenal (HPA) axis. The use of music and directed imagery on cortisol induced stress has also received wide attention. [86–88] Music has also been used as a wellness tool prior to performing procedures in hospitals for the purpose of alleviating stress and anxiety, besides finding use as a therapeutic agent in procedures or surgeries so as to relieve the patients of the pain and dependence on the analgesics. [89,90]

Indian Classical Music and its significance as a modulator of emotions-The justification for the present research study

Indian classical music is endowed with a rich heritage firmly rooted in culture and spanning over several centuries. Indian Classical music is both an art and science embedded in a distinct manner that lends itself to evidence-based medicine in the contemporary scenario prevailing at the interface of modern and complementary (adjuvant) medicine. [91] In recent times, the relevance and importance of Indian Classical music is increasingly being felt not only from the standpoint of an art form but also from the perspectives of evidence-based science and medicine. [92]

Indian Classical music has inherent qualities to evoke intense emotions through delicate and subtle modalities that pave the way for bliss, peace, and tranquility of the mind. Music has now become an important facet of Mind Body Medicine, not only from the context of wellness but also from the standpoint of therapeutics.[93]

The nucleus of Indian classical music is its emotive power. The *raga(s)* represents the melodic, contour based, robust structural and functional framework that elicits specific emotions in the hearts and minds of the listener. Each *raga* is said to be associated with a particular mood or sentiment. As the musician manoeuvres the musical notes and improvises within the essential framework, a kaleidoscopic landscape is created that culminates in a unique listening experience. Thus, music becomes a compact but comprehensive vessel for facilitating emotional expression, thereby allowing the listeners to develop a harmonious nexus with their own feelings and experiences.[94]

Indian classical music possesses two major genres, namely the Carnatic and the Hindustani. The Carnatic genre has 72 parent *raga(s)* or musical modes, known as *melakarta raga(s)* or *janaka raga(s),* and several *raga(s),* termed the *janya raga(s),* originate from these, aided by permutation, combination, addition, or deletion of musical notes. On the contrary, Hindustani music has only ten *thaats,* or parent musical scales, from which several *raga(s)* have sprung.

Expressiveness is the hallmark of music. The Indian classical music provides a robust platform for musicians to communicate at ease and convey their innermost

emotions and feelings through their instruments or vocals. [95] The intricate melodies and complex rhythmic patterns are not merely technically challenging exercises, but they essentially serve as a medium of self-expression and storytelling. Musicians use subtle techniques like *meend* (gliding between musical notes), *gamakas* (ornamental embellishments through swaying of the musical notes), and *taans* (rapid-paced melodic patterns) to convey myriad emotions. The improvisational nature of Indian classical music permits the artistes to explore their creativity, thereby conferring distinctiveness on the compositions, besides enabling ample scope for spontaneity and innovation.

Beyond its emotive and expressive qualities, Indian classical music has the remarkable ability to induce a state of ultimate peace and bliss. It is believed that this music has a profound impact on the human mind, body, and soul. The intricate melodies and the repetitive rhythm patterns have a calming effect, slowing down the pace of our thoughts and helping us attain a meditative state. [96] As we immerse ourselves in the mesmerizing sounds, we become aware of a profound stillness within, transcending the chaos of daily life. This music has the power to transport us to a world of serenity, where the mind finds solace and the spirit finds nourishment.

Indian classical music is deeply rooted in spirituality, and hence, even in the present context, music of this genre is relevant, as it satisfies the concept of health defined by the WHO. [97] The *raga(s),* or musical modes, are believed to be in harmony with the vibrations of the universe, and more evidence in basic and applied medical sciences is beginning to accumulate, signifying the holistic value of music not only as a wellness tool but also as a healing tool. [98].

This is one of the main reasons for having undertaken the study, especially at a higher educational institution such as ours, which has a hospital, a tertiary health care setting, besides an exclusive School of Music Therapy under the umbrella of a dedicated Institute for Salutogenesis (wellness) & Complementary Medicine, located within the same campus.

Music Therapy and Breast Milk Secretion

Musical interventions have recorded increased milk secretion in mothers who expressed milk for preterm babies[99] that include relaxation and visual imagery

techniques,[34] reduction in anxiety and relaxation prior to breastfeeding, perceived fatigue in labor, increase in immediate postpartum lactation in normal deliveries, and increased frequency of breastfeeding.[3,7,14,100-103]

Studies on Pregnancy in the Indian Subcontinent with reference to Oxytocin and Prolactin levels

Evidence pertaining to the use of preferred music in prenatal pregnant women who had prehypertension[104] is available. Music and chanting as a modality for wellness have been attempted during the first and second stages of labor.[105] The use of organized structured sessions for postnatal women to help comprehend the changes in maternal perception of breastfeeding satisfaction has also been documented.[106,107]

The present study has attempted to observe and record the effect of administering music on the levels of OT and PRL in mothers. The study employed a mix of live vocal music and imagery with the improvisation based on the Indian musical modes *raga(s)* forming the core, hitherto not attempted in the study population. The study has duly documented the impact of music as a tool of wellness on oxidative stress. To assess the impact, we had quantitated the product of lipid peroxidation as a biomarker in mothers, following a normal delivery. This could prove to be a consequent observation to breastfeeding being positive with music as a tool of wellness. Our study would acquire additional relevance since there is a lacuna, as depicted by the existing scenario.

Justification for this study, in the light of the literature

1. Few studies have recorded the positive effects of listening to music on breast milk secretion and the hormonal markers OT in new mothers. However, most of the studies have been enabled in the west, and very few reports from India are presently available on the effect of music pertaining to the hormonal markers, especially using Indian Classical music modes and imagery.

2. There are very few studies available to cite the influence of Indian classical music on PRL & oxidative stress, both in the national and international context from the standpoint of breastfeeding and hence our study was planned to generate evidence-based research in the realms of a few relevant endocrine and

non-endocrine biomarkers portraying the qualitative and quantitative aspects related to breast milk secretion.

3. Furthermore, the impetus provided to breastfeeding by the WHO and the Ministry of Women and Child Development, Government of India have been taken due cognizance of, while devising the study.

4. Very few studies are available till date pertaining to the concerted use of musical modes or *raga(s)* belonging to the Indian Classical Music, in association with a uniquely conceived imagery.

CHAPTER 4

Subjects, Study Design, Methodology and Statistical Tools employed

This was a prospective randomized controlled study which was conducted at the Mahatma Gandhi Medical College and Research Institute Hospital, a rural tertiary care hospital. The Institutional Human Ethics Committee (IHEC-PhD Project/08/2019/007) approved this study. Primigravida women aged between 19 and 35 years were recruited for the study, primarily from the department of Obstetrics and Gynecology during labor and post-natal periods. Written informed consent was obtained from the participants, prior to initiating the study.

Inclusion Criteria:

- All primigravida mothers, in the age group of 19 to 35 years who had normal delivery were included. The study subjects who were enrolled based on informed consent were duly monitored by qualified clinicians in the department of Obstetrics and Gynecology. The study was begun only after obtaining the clearance from the Institute Ethics Committee.

Exclusion Criteria:

- Mothers who were hard of hearing were excluded. Mothers who had other co-morbid conditions such as diabetes, hypertension or other endocrinological abnormalities that warranted medical treatment were also promptly excluded.

Study groups

The Number of Groups is: 2

A. Music therapy group: Received music therapy intervention

B. Control group – No music therapy intervention, regular medical care

Sample size calculation

$$n = \frac{2\sigma^2 (Z_{1-\beta} + Z_{1-\alpha/2})^2}{(\mu_1 - \mu_2)^2}$$

Taking cognizance of the mean value 386, SD at 135, pertaining to the levels of prolactin in women, following normal vaginal delivery, as indicated in the previous literature, we arrived at a total sample size of 48. In anticipation of a 25% dropout rate, an increase in sample size during the course of the study was rounded off to 30 per group. N=30, Music intervention group (Group A), n=30– Control group (Group B).

BRIEF EXPLANATION OF THE PROCEDURE

All primigravida mothers who fulfilled the inclusion criteria were explained about the benefits of the study in the vernacular language.

After obtaining informed consent, the study subjects were randomly allocated to either intervention or control groups by a third person who was not involved in the study and the information was made available in concealed covers. The patients in the control group were subjected to conventional nursing care, while the patients in the intervention group(A) were administered with music, in addition to nursing care for 45 minutes twice every day for three days in the morning and evening, in a separate room allocated to ensure there is no spill-over of music to the patients allocated to the control group. Separate consent was taken from the subjects in the control group. Recorded tracks were provided to subjects in the intervention group through an electronic device at their homes, twice a day after they were discharged, until the day of follow up at 45 days.

Criteria for the selection of the *raga(s)*

The *raga(s)* were selected based on the objective, specific needs by taking due care not to compromise on the inherent aesthetics, yet at the same time bestowing the attributes of simplicity, pleasantness and aural comfort.

Six ragas were selected, keeping in mind the following details: -

- Ease of improvisation
- Adherence to aesthetics of the *raga* chosen without mutilating its classical properties or form
- Use of signature phrases of each of the *raga(s)* to uphold the authenticity of these musical modes was in place. *chAya* or amsa refers to the melodic

note(s) of the *raga* or musical mode which was delineated, in accordance with the characteristic phrases, termed the *mUrchana,* in the musical parlance. The *nyAsa* swara or the anchor musical note was also taken into due account

- The ability of the raga to help improvise, in accordance with the properties needed to relax was duly considered
- The ability to linger on notes and to be able to delineate repeated phrases that are regarded as cardinal aspects of any music that possesses relaxing properties was also promulgated

METHODS

Selection of ragas: An objective step by step process of selection/elimination was enabled.

- *Raga(s)* with all the seven musical notes or *swarA(s)* termed the *(sampUrNa raga(s) were only employed*
- *Raga(s)* that are in possession of *vivaadi swara(s)* (with two or more musical notes very close to each other/ discordant notes) were eschewed. This is attributed to the fact that the discordant *raga(s*) are said to be uncomfortable to the ear and hence any negative or uncomfortable aspect of a *raga* was taken into due consideration and the use of the same was avoided
- The use of *raga(s)* that warranted the delineation of rapid movement in rendition were rejected
- The selected *raga(s)* had musical notes spread between two semitones and then a full or one and half semi tone space that allowed the ability to linger
- The signature phrases of these *raga(s)* that are normally repetitive in nature confer on each raga a distinct difference and this formed an important component in the administration of music

The following *raga(s)* were employed in the study The term *Melam* indicated within parenthesis refers to the *melakarta* or main *raga*

1. MAyAmaLavagauLa (Melam 15)
2. ChakravAkam (Melam 16)
3. KeeravAni (Melam 21)
4. Kharaharapriya (Melam 22)
5. SarasAngi (melam 27)
6. Simhendra Madhyamam (Melam 57)

Study Methodology:

a. **Sample collections**: Oxytocin, prolactin and malondialdehyde (product of lipid peroxidation, attributed to oxidative stress) were measured in blood samples once before labor began, once at 24 hours post-delivery and once after three days (72 hours). The frequency of collection of blood samples was based on the suggestion provided by the Research Advisory Committee. Subjects who were given more than 10 units of oxytocin following delivery were dropped from the study. As and when samples were collected, they were stored at -80^{o} C at the Central Interdisciplinary Research Facility (CIDRF/MGMARI), SBV. The same time for procuring samples was uniformly followed to the most possible extent. The weight of the babies was taken on the day of first immunization for both the groups and the same weighing machine in working condition was utilized for all the purpose of recording the weights of all the babies. This was intended to minimize variation

b. **Intervention**: Music was administered for a total of six sessions post-delivery and for 45 minutes.

c. **Evaluation/assessment:**
   i. Oxytocin and prolactin were processed with ELISA Kits supplied by Bioassay (SYNERGY, Chennai India). Oxidative stress was monitored through the estimation of malondialdehyde (MDA), a marker of lipid peroxidation.

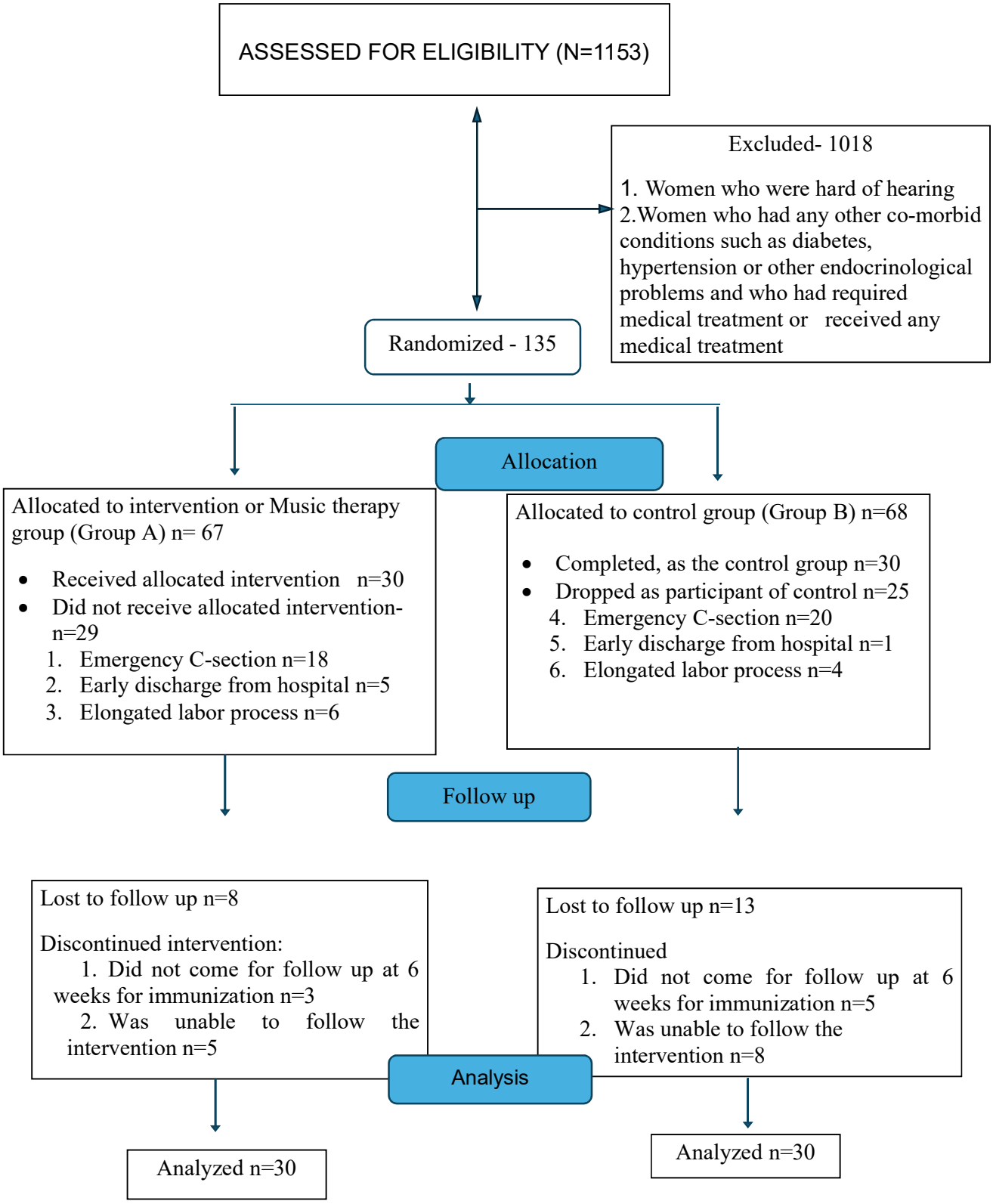
ii. UNICEF breast observational checklist was employed in the daily assessment, following the birth of the child, until the day of discharge.

iii. Maternal Satisfaction on breastfeeding was assessed by Maternal breastfeeding satisfaction evaluation scale (MBFES) after 4 days and 6 weeks respectively. The Maternal Breast-feeding Evaluation scale (MBFES) possesses three subscales that measure the maternal needs and baby's growth.

1. Subscale one (SS1) pertains to maternal enjoyment and role attainment.
2. Subscale two (SS2) pertains to the satisfaction and growth of the baby.
3. Subscale three (SS3) pertains to questions related to maternal lifestyle and body image. The third scale has a greater number of negative statements as compared to scale one and two)

d. A checklist was used for the subjects to enable follow-up, when the investigator called the mother to self-administer the recorded music, electronically, at home. This checklist was used to analyze and/or note the confounding factors, while the study subjects were at home. Patients not reporting for first follow up after 6 weeks were considered dropouts and excluded from the study.

Flow-chart of the sequence of events during the study


ASSESSED FOR ELIGIBILITY (N=1153)
Excluded- 1018
1. Women who were hard of hearing
2.Women who had any other co-morbid conditions such as diabetes, hypertension or other endocrinological problems and who had required medical treatment or received any medical treatment
Randomized - 135
Allocation
Allocated to intervention or Music therapy group (Group A) n= 67
Received allocated intervention n=30
Did not receive allocated intervention- n=29
1. Emergency C-section n=18
2. Early discharge from hospital n=5
3. Elongated labor process n=6
Allocated to control group (Group B) n=68
Completed, as the control group n=30
Dropped as participant of control n=25
4. Emergency C-section n=20
5. Early discharge from hospital n=1
6. Elongated labor process n=4
Follow up
Lost to follow up n=8
Discontinued intervention:
1. Did not come for follow up at 6 weeks for immunization n=3
2. Was unable to follow the intervention n=5
Lost to follow up n=13
Discontinued
1. Did not come for follow up at 6 weeks for immunization n=5
2. Was unable to follow the intervention n=8
Analysis
Analyzed n=30
Analyzed n=30

Imagery script- English

Part 1-Induction

Make yourself as comfortable as you can……. let your clothes be loose, comfortable and free of any tightness ……... position yourself so that you are comfortable and let your hands and legs be free and loose

Part 2. Body scanning

Now……

Be aware of your breath, keep in pace with the rhythm of your body. Notice how the breath travels in and out of you…. let yourself be comfortable and free……slowly take a few deep breaths, feel the air flowing throughout your body loosening up all the tight corners. As you exhale out feel all your thoughts or memories that you have at the moment. As you breath in feel it calm and comfort you..., and as you breathe out imagine your feelings..., and emotions floating away..., allowing yourself to become more and more restful. Now as the music starts playing, feel the music filling throughout your body…imagine it flowing from the top of your head down to your face and neck…. Slowly spreading to both sides of your shoulder…. arms…. hands and fingers…moving down to your chest…. stomach and abdomen…feel the brightness of the light with the sound of the music spreading calmness through your body down to your hips…. thighs…. Knees…. legs and toes……let yourself be in this restful position…

Part 3. Imagery

Now we will go through a journey of bonding with your baby….feel this to be the first phase of physical touch and bonding you have with your baby…. This bonding will keep you close to your child and give you the chance to let it feel and touch you as this the first time he or she gets to feel you… this will be a chance for the baby to know you and connect with you…. Imagine holding your baby in your hand …. Observe how it feels to hold the baby in your hand……is the baby sleeping ……you look into its face and feel a sense of satisfaction).…….imagine that you are talking to the baby…. you are my priceless gift……I thank god for the lovely gift given to me……...I will take care of you as well as I can(to have a comfortable life……. imagine you are going to feed the baby now…….feel the breast filling with milk to feed your baby……listen to the music and imagine feeding the baby….you are still

listening to the music and feel the anxiety and discomfort fade away with the music……. imagine how your child is going to sleep well as he/ she goes to sleep…….. you will be in this restful position once you complete feeding the baby…. your baby is also relaxed and feeding comfortably, imagine and feel how your baby cuddles in your arms…..completely trusting you to take care of him/her ….imagine moving from one side to another as you feed your baby and humming slowly as it goes to sleep….closing its eyes gently ……holding your little finger with its tiny fingers…..touching you and feeling secure…..your baby is now sleeping and can be put down on the bed slowly……stay in this state of comfort and listen to the music….slowly breathing in and out……

(Music: 10- 12minutes)

Part 4. End session

Slowly you can hear the music fade away…..its time to come back…..remember that you could come back to this place whenever you feel like……. now, move your legs and hands a little ……. feel your body and mind come back to the present……. Feel free to open your eyes whenever you are comfortable

The imagery script in the vernacular language, namely Tamil is available in the Appendix.

Statistical tools employed:

The study involved the use of JASP 18.0 software for the purpose of data analysis.

1. The demographic details for age and education were analyzed statistical tools including frequencies, mean and SD.
2. The parameter analysis for within the group involved the use of paired T-Test and Repeated Measures ANOVA wherever required.
3. The analysis of the parameters between the groups was performed by deploying independent t-test.
4. Correlation analysis was enabled to ascertain and quantitate the strength and direction of the relationship between the variables.

CHAPTER 5

Study Outcome (Results)

The study involved a data sheet with complete details of the subjects age, education, as well as the blood group. The results presented are based on the values obtained from the Serum samples of the subjects, as per the protocol. The MBFES scale was utilized for the purpose of assessment of breastfeeding satisfaction, from the mother's perspective. The UNICEF breastfeeding scale was used to provide us with the details of breastfeeding comfort of the mother and the effects of breastfeeding on the infant. The secondary data on hemodynamic data (Blood pressure, Heart Rate, Blood Glucose, WBC, RBC, Platelets, Urine pH) was obtained from the blood tests taken as part of standard medical care

The descriptive statistics essentially comprise of Mean, Standard deviation and Frequency, whereas the inferential statistics included the use of T-Test (Independent t- test and paired t-test), Repeated measures ANOVA, Correlation, Two Way ANOVA.

The results depicted below are based on the objectives of the study. The demographic details of the study participants are indicated in Table 1A and B.

I. DEMOGRAPHIC DETAILS

Table 1 A: Age Range of the Study Subjects

Variable	Group	n	Mean	SD	Min.	Max.
Age (Range in years)	Music therapy intervention group (Group A)	30	25.40	3.29	19	32
	Control group (Group B)	30	25.10	2.80	21	31

Table 1 b: Educational Level of the Study Subjects

Group	1	2	3	4	Total
Music therapy intervention group (A)	5	0	23	2	30
Control group (B)	11	2	15	2	30
Total	16	2	38	4	60

Primary School 2. High school 3. Graduates 4. Postgraduates and above

The results indicate that the mean age was around 25 years in both the groups (Table1 A). Furthermore, the majority of the study subjects in both the groups were graduates (Table 1 B).

LEVELS OF OXYTOCIN, PROLACTIN:

The changes in the blood levels of OT, PRL and oxidative stress marker, namely malondialdehyde (MDA) were compared essentially between the music therapy group (Group A) and Control (Group B), to elicit statistically significant relationship among the parameters, but also within the group, namely the intervention group (A).

The Independent T-test depicted the outcome of data analysis between the groups, while the Repeated measure ANOVA results are a visual representation of changes *within the group* and *between the groups,* based on the data pertaining to baselines 1, 2 and post scores.

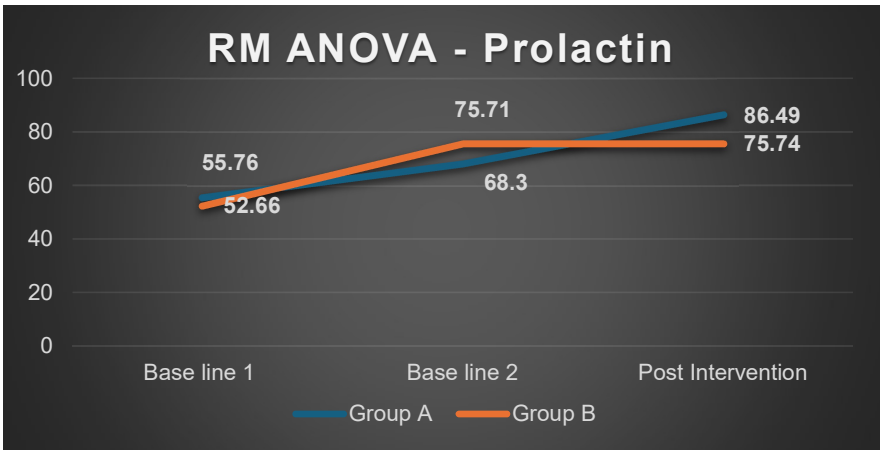
Table 2: Prolactin Levels Between the Study Groups

Days	Group	n	Mean	SD	Df	P
BL 1: At first stage of labor	A	30	55.75	15.23	58	0.657
	B	30	52.66	15.99		
BL 2: post-delivery 8 hours	A	30	68.30	13.12	58	0.011*
	B	30	75.71	6.57		
Post - 72 hours following delivery	A	30	86.48	5.56	58	0.001**
	B	30	75.74	8.11		

Group A- Music Intervention; Group B- Control;BL1 - Baseline 1;BL 2 - Baseline 2

Table.2 summarizes the status of PRL between the two groups, but as a measure of comparison between the two baselines, namely Baseline 1 (at the first stage of labor) and Baseline 2 (post-delivery 8 hours) as well as 72 hours, post-delivery.

The results clearly indicate that the comparison of baseline scores between the two groups is not significant. However, the data revealed a paradox, namely an increase in prolactin right after delivery. But post the 72 hour of music therapy intervention, Group A exhibited a significant increase in prolactin levels (Table 2). Fig.3 depicts the movement of the means of the scores of both baselines and the post intervention. The graph also shows the changes within the groups as well as between the groups.



Group A- Music intervention Group B-Control

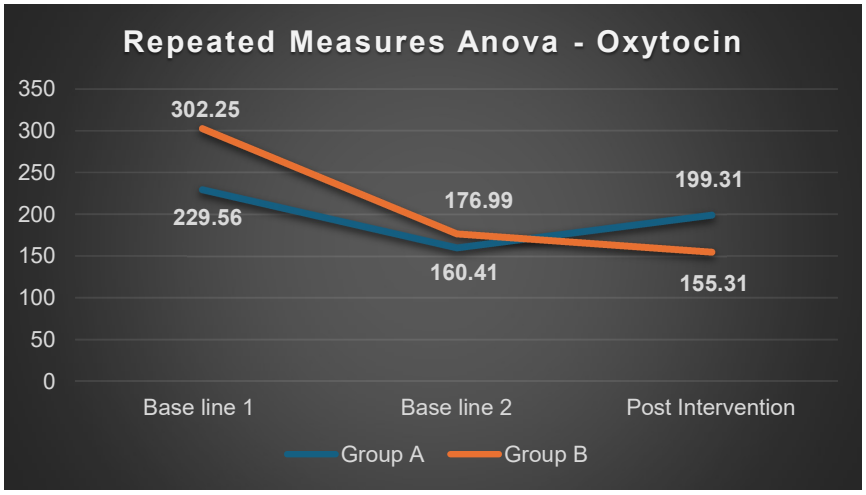
Fig 3: Repeated measures ANOVA for the comparison between the groups (Prolactin)

Table 3: Oxytocin Levels Between the Groups

Days	Group	n	Mean	SD	DF	P-Value
BL 1: At first stage of labor	A	30	229.56	57.04	58	0.399
	B	30	302.25	49.10		
BL 2: post-delivery 8 hours	A	30	160.42	44.25	58	0.181
	B	30	176.99	45.52		
72 hours following delivery	A	30	199.31	45.70	58	0.001**
	B	30	155.31	34.69		

Group A- Music Intervention; Group B- Control; BL1 - Baseline 1; BL 2 - Baseline 2

Table 3 exhibits the results of the music therapy intervention at 72 hours, following delivery, pertaining to oxytocin, in comparison to the control group and reveals statistical significance, as exemplified by the p value (0.001**). The results are shown for easy comprehension as a graph (Fig.4), which shows a steady decrease in oxytocin in the control group(B), and though the 2nd baseline has a drop in the Intervention Group(A), the post intervention scores have a significant increase.



Group A- Music intervention Group B-Control

Fig. 4. Repeated measures of ANOVA for the comparison between the Groups Oxytocin

OXIDATIVE STRESS BIOMARKER

Oxidative stress markers, namely malondialdehyde (MDA) were compared essentially between the music therapy group (Group A) and Control (Group B), in order to elicit statistically significant relationship among the parameters, but also within the group, namely the intervention group (Group A).

Table 4: Comparison of Magnitude of Oxidative Stress Between the Two Groups

Days	Group	n	Mean	SD	DF	P-Value
BL 1-At first stage of labor	**A**	30	5.807	1.519	58	0.008
	B	30	6.944	0.789		
BL 2-Post-delivery 8 hours	**A**	30	5.753	1.449	58	0.019*
	B	30	6.727	0.705		
72 hours following delivery	**A**	30	5.748	1.396	58	0.001**
	B	30	7.095	0.957		

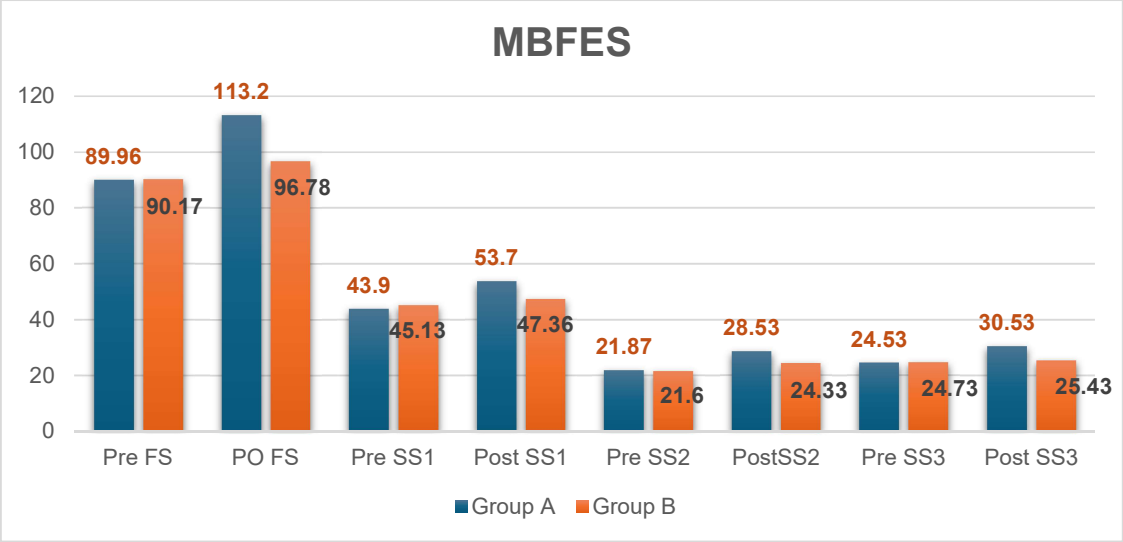
Group A- Music Intervention; Group B- Control. BL1 - Baseline 1; BL 2- Baseline 2

The results shown in Table 4 unequivocally demonstrate the significant attenuation of oxidative stress when the comparison was affected between the groups, 72 hours post-partum. The data provides us with the trend of oxidative stress in both the groups. The steady decrease in both groups shows the changes that may occur in extreme physical stress and the reduction in the scores (which is significant in both groups) could be the reduced stress after delivery. However, the post scores of interventions show a significant reduction in comparison to the control Group.

MATERNAL BREASTFEEDING EVALUATION SCALE(MBFES)

The maternal breastfeeding satisfaction of the mothers at the end of the 45-day period, post-delivery and following home based music listening experience was computed between music intervention group (Group A) and control group (Group B).

The results depicted in Fig.5 represent the changes observed in the Maternal Breastfeeding Evaluation Scale (MBFES)



MBFES-Maternal Breast- Feeding Evaluation Scale Series 1 = Group A -Intervention (Blue); series 2 = Group B – Control (Orange).

Fig 5- Comparison of the Three subscales and the full-scale scores between Group A and Group B(MBFES)

The data in fig 5 above, depicts an increase in both groups of full scale & subscale one. There is a significant increase in Group A with a P <0.001. There is no change in Group B with respect to Subscale 3, but a mild increase in Group A.

Subscale two shows a mild increase in both groups with a tendency towards more increase in Group A and the significance of P=<0.001.

UNICEF BREASTFEEDING CHECK LIST

The UNICEF breastfeeding check list was employed for the purpose of comparison between the groups on all the three days (72-hour period), with reference to the number of feeds, feeding time, feeding comfort and change of nappies.

Table 5: UNICEF Breastfeeding Checklist

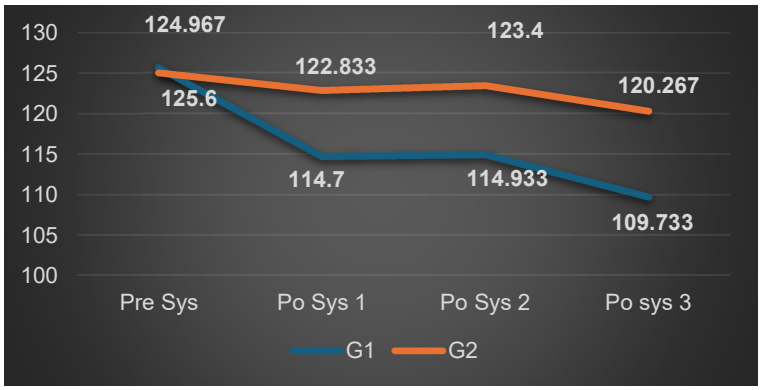
Details	Group	n	Mean	SD	P value
Number of feeds on D1	**A**	30	1.267	0.450	0.098
	B	30	1.100	0.305	
Number of feeds on D2	**A**	30	1.833	0.379	**< .001**
	B	30	1.200	0.407	
Number of feeds on D3	**A**	30	1.900	0.305	0.001
	B	30	1.533	0.507	
Feed time on D1	**A**	30	1.433	0.504	0.104
	B	30	1.233	0.430	
Feed time on D2	**A**	30	2.433	0.626	**< 0.001**
	B	30	1.400	0.563	
Feed time on D3	**A**	30	3.367	0.669	**< 0.001**
	B	30	1.933	0.740	
Feeding comfort on D 1	**A**	30	1.733	1.999	0.589
	B	30	1.933	0.254	
Feeding comfort on D2	**A**	30	1.100	0.305	0.001
	B	30	1.933	0.254	
Feeding comfort on D3	**A**	30	1.000	0.000	0.001
	B	30	1.533	0.507	
Number of nappies changed on D1	**A**	30	1.767	0.430	0.001
	B	30	1.233	0.430	
Number of nappies changed on D2	**A**	30	1.867	0.346	0.001
	B	30	1.367	0.490	
Number of nappies changed on D3	**A**	30	1.900	0.305	0.001
	B	30	1.467	0.507	
	B	30	1.100	0.305	

Group A – Music Intervention; Group B- Control ; D1-day1;D2-Day 2;D3-Day 3

The data reveals that the number of feeds had significantly increased in Group A on Day 2 and Day 3; the time of each feed had increased on Day 2 and Day 3. The level of comfort during feeding was interestingly significant only on Day 2 and D3; The number of nappies changed was found to be significant on all the three days

COMPARISON OF PHYSIOLOGICAL PARAMETERS OF BLOOD PRESSURE AND HEART RATE BETWEEN THE TWO GROUPS

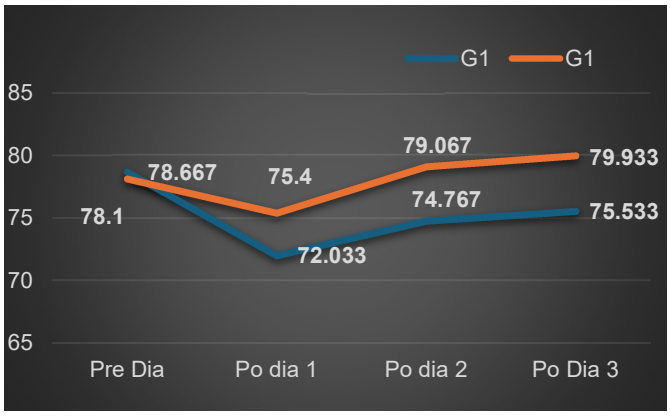
The figures below depict visually the comparison between the two groups and how the changes have occurred in the physiological parameters, within the groups



G1=Group A(Intervention); G2=Group B(control)

Fig :6 Blood Pressure (Systolic)

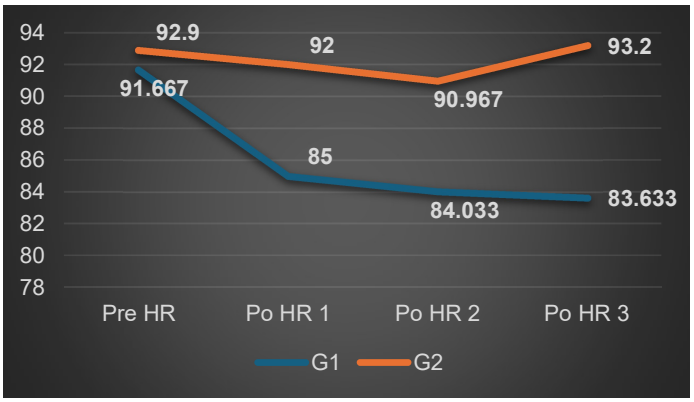
The pre and post scores of the BP Systolic were found to be significant with a p value of <0.001post the day one of the intervention in comparison with the pre-test scores as well as between the two groups. (**Fig 6**)



G1=Group A(Intervention);G2=Group B(control)

Fig : 7 Blood Pressure diastolic

The data on BP Diastolic scores were found to be moderately significant with P value of 0.003 post day two of the intervention as well as post scores on day three of the intervention with value of P =0.001. between the groups as well as within the group. (**Fig 7**)



G1=Group A(Intervention);G2=Group B(control)

Fig :8 Heart Rate

The Post scores of heart rate was found to be moderately significant with a P value of 0.027 and a more significant change on the day three of the intervention with a post score of P=0.003.(**Fig 8**)

Table 6: **Mean Arterial Pressure (MAP)**- Independent T Test Comparison Between Group A and Group B

Days	Group	n	Mean	SD	DF	P-Value
MAPD1 PRE	A	30	94.62	6.12	58	0.496
	B	30	93.87	7.35		
MAP D1POST	A	30	86.26	4.93	58	0.014**
	B	30	91.21	7.62		
MAPD2POST	A	30	87.97	5.85	58	<0.001***
	B	30	93.44	4.97		
MAPD3POST	A	30	86.93	7.30	58	<0.001***
	B	30	93.38	8.00		

MAP: Mean Arterial Pressure

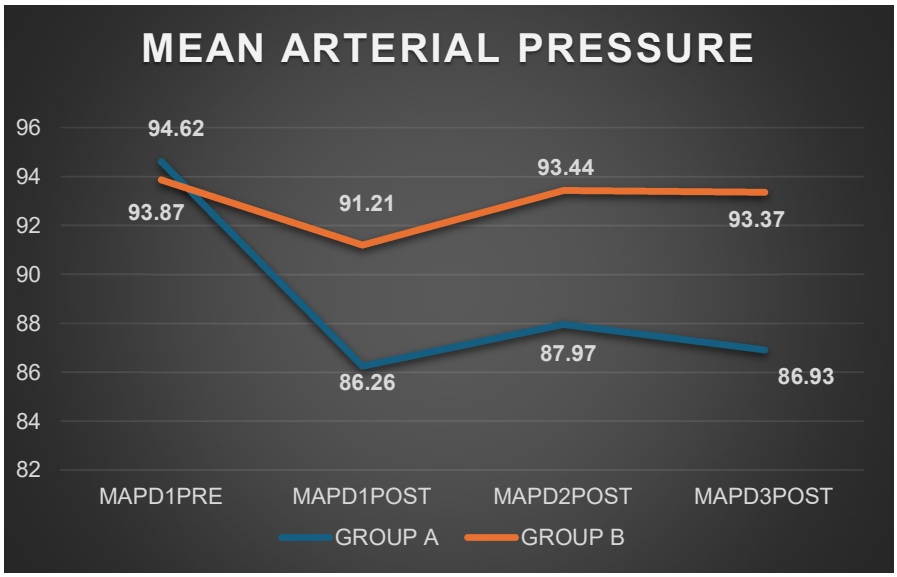


Fig 9: Repeated measures ANOVA- Mean Arterial pressure of both the groups

The mean arterial pressure between the groups are observed to be to have a gradual decrease from the first day to the post of the 3 day which are found to be significant(P=<0.001). The results are depicted in **Table 6 and Fig.9**.

The biochemical parameters and hematological indices in endocrine driven breast milk secretion did not depict substantial difference, probably attributed to the short period of intervention, within which the changes in blood parameters were not conspicuous. The results are not shown here.

Correlation tables

With the aim of comprehending the association, if any, among the major parameters, namely OT, PRL and biomarker of oxidative stress, the following analyses were enabled and are shown in Tables 8-10 corresponding to oxidative stress biomarker, OT and PRL respectively.

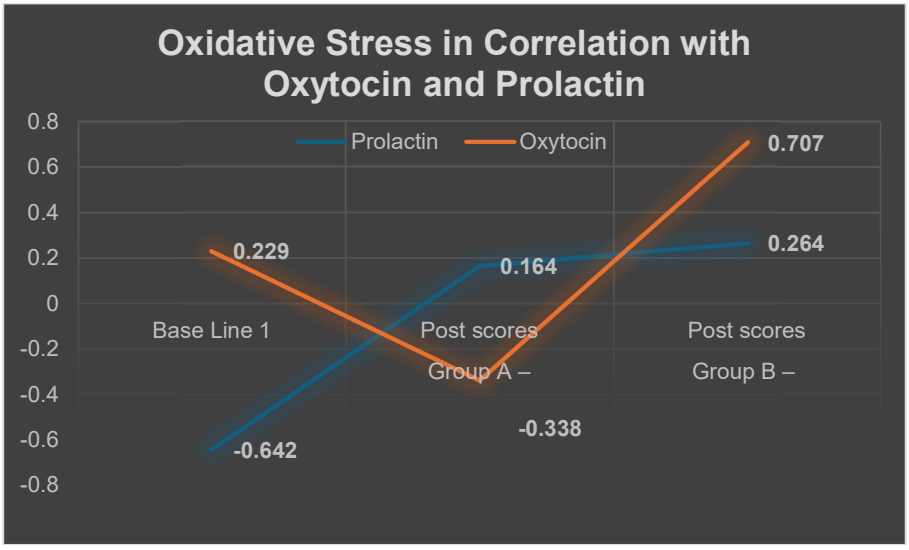
Table 7: Oxidative stress: Base line 1 & Post scores (correlation coefficient) with other variables pertaining to Group (A) Intervention and control (Group B)

Variables	Base Line 1	Group A – PS	Group B – PS
Prolactin (PRL)	-0.642**	0.164	0.284
Oxytocin (OT)	0.229	-0.398*	0.707***
Hemoglobin (Hb)	-0.233	-0.005	-0.341
White Blood Cells (Leucocytes)	-0.378*	0.057	-0.249
Red Blood Cells (Erythrocytes)	-0.253	-0.016	-0.436*
Blood Glucose	-0.226	0.227	-0.084
Platelet	0.136	0.104	0.352
Urine pH	-0.027	-0.119	0.150
Full Scale, MBFES	0.273*	-0.264	-0.045
Sub scale 1, MBFES	-0.542**	-0.060	0.424*
Sub Scale 2, MBFES	-0.118	-0.441	-0.262
Sub Scale 3, MBFES	-0.004	-0.009	-0.467

Highly significant =*; Moderate significance=**; Significant=* ;MBFES- Maternal Breastfeeding Evaluation Scale**

Table 7 depicts the relationship between Baseline Oxidative stress (ODS) with the Base line correlation coefficient of the other variables, with a significant negative correlation in WBC and the subscale scale 1 of the Maternal breastfeeding scale in the baseline. In the Post score correlation coefficient of group A(Intervention), we have a negative correlation with oxidative stress, RBC, and significant negative correlation with subscale 1 and 3. Whereas in control or Group B, we can observe that there is a positive increase with Oxidative stress.

Fig.10 depicts the correlation of oxidative stress to oxytocin and prolactin between the first baseline and post intervention period corresponding to 72 hours.



Group A(Intervention) ; Group B(Control)

Fig 10: Depicts the correlation of oxidative stress to Oxytocin(orange) and Prolactin (blue) between the first baseline, and post intervention period of 72 hours.

Table 8: Oxytocin: Base line & post Correlation Coefficient pertaining to other variables between Intervention (group A) and control (Group B)

Variables	Baseline 1	Group A Post-Scores	Group B- Post scores
Prolactin	0.189	0.167	0.249
Oxidative stress	-0.229	-0.388*	0.707***
Hemoglobin	0.033	-0.225	-0.323
White Blood Cells	0.010	0.015	-0.119
Red Blood Cells	0.281*	-0.057	-0.596**
Blood Glucose	0.152	-0.153	-0.119
Platelet	0.082	-0.007	0.403*
Urine Ph	-0.087	0.226	-0.152
Full Scale, MBFES	-0.048	-0.371*	-0.189
Sub scale 1, MBFES	-0.064	-0.060	0.184
Sub Scale 2, MBFES	0.165	-0.135	0.0461*
Sub Scale 3, MBFES	-0.217	0.150	-0.131

Highly significant =*; Moderate significance=**; Significant=***

The base line co-efficient correlation between oxytocin with other variables do not show any causal significance. However, post intervention in Group A, we can see that there is a significant negative correlation with RBC and significant correlation

with Full MBFES scale, Oxidative stress and Platelets. Whereas with control (group B), we can envisage a significant negative correlation with oxidative stress (Table 8).

Table 9: Prolactin-Base line 1 & Post Correlation Coefficient with other variables pertaining to Intervention and control groups

Variables	Baseline 1	Group A – Post- Scores	Group B- Post scores
Oxytocin	0.189	0.167	0.249
Oxidative stress	-0.642**	0.164	0.284
Hemoglobin	0.260*	-0.210	-0.065
White Blood Cells	0.263*	0.145	0.092
Red Blood Cells	0.296*	-0.111	-0.329
Blood Glucose	0.194	-0.048	0.332
Platelet	-0.032	-0.047	0.082
Urine pH	-0.054	-0.543**	-0.042
Full Scale MBFES	-0.202	-0.130	-0.166
Sub scale 1, MBFES	-0.377*	0.123	0.039
Sub Scale 2, MBFES	0.007	-0.210	-0.087
Sub Scale 3, MBFES	-0.029	-0.133	-0.170

Highly significant =*; Moderate significance=**; Significant=***

Considering the baseline coefficient of prolactin in relation to Oxytocin and Oxidative stress as well as the physiological and hemodynamic variables, it can be observed to have a negative correlation with oxidative stress and Subscale 1 of MBFES. When compared with the post scores in the intervention group, it could be observed that it is negative with Urine pH. while there is no significance. An increase is seen from a negative score to a positive score with Oxidative stress, Hb, WBC, RBC as well as Subscale 1 in the control group.

The following tables are the correlation coefficient of baseline 2 values of Prolactin, oxytocin and oxidative stress with other parameters of the study. Base line 2 is the sample taken right after delivery from both groups prior to providing the intervention

Table 10: Oxidative stress Baseline 2 &Post Correlation Coefficient with reference to other variables pertaining to Intervention and control groups

Variables	Base Line 2	Group A – PS	Group B – PS
Prolactin (PRL)	0.163	0.256	0.138
Oxytocin (OT)	0.516**	0.398*	0.798***
Hemoglobin (Hb)	0.163	-0.010	-0.382*
White Blood Cells (Leucocytes)	-0.106	-0.092	-0.123
Red Blood Cells (Erythrocytes)	-0.288*	0.001	-0.528**
Blood Glucose	0.051	0.209	-0.080
Platelet	0.166	0.123	-0.396*
Urine pH	-0.098	-0.102	-0.089
MBFES FULL SCALE	0.124	0.198	0.070
MBFES SS1	0.256*	0.251	0.452*
MBFES SS2	-0.423*	-0.562**	-0.328
MBFES SS3	-0.143	-0.168	-0.377*

Highly significant =*; Moderate significance=**; Significant=***

The correlation of Oxidative stress depicts a significant with oxytocin, RBC and MBFES subscale 2. With oxytocin the positive coefficient was positive, however in comparison to control group B, there is lesser positive correlation. With the MBFES subscale 2, there is moderate significant negative correlation in comparison to group 2.

Table 11: Prolactin Baseline 2 & Post Correlation Coefficient with other variables pertaining to Intervention and control groups

Variables	Base Line 2	Group A – Post scores	Group B – Post scores
Oxidative stress	0.264*	0.361*	0.225
Oxytocin (OT)	0.041	0.244	0.290
Hemoglobin (Hb)	-0.204	-0.180	-0.189
White Blood Cells (Leucocytes)	-0.004	-0.044	0.105
Red Blood Cells (Erythrocytes)	0.045	0.159	-0.174
Blood Glucose	-0.074	-0.080	-0.240
Platelet	-0.044	0.002	-0.007
Urine pH	-0.053	-0.162	0.021
MBFES FULL SCALE	0.136	0.171	0.142
MBFES SS1	-0.292*	-0.094	0.031
MBFES SS2	-0.096	-0.152	-0.054
MBFES SS3	-0.004	-0.121	0.152

Highly significant =*; Moderate significance=**; Significant=***

The correlation co-efficient of prolactin with other parameters do not depict any significant correlation with any of the parameters**.**

Table 12: Oxytocin Baseline 2 & Post Correlation Coefficient with other variables pertaining to Intervention and control groups

Variables	BaseLine 2	Group A –PS	Group B – PS
Oxidative stress	0.700***	0.552**	0.823***
Prolactin(PRL)	0.303*	0.244	0.164
Hemoglobin (Hb)	-0.134	-0.260	-0.427*
White Blood Cells (Leucocytes)	-0.247	-0.021	-0.076
Red Blood Cells (Erythrocytes)	-0.068	0.136	-0.496*
Blood Glucose	-0.359*	-0.197	0.054
Platelet	0.026	-0.009	0.415*
Urine pH	-0.043	0.017	-0.055
MBFES FULL SCALE	0.138	0.113	0.167
MBFES SS1	0.026	0.169	0.360
MBFES SS2	-0.134	-0.114	-0.552
MBFES SS3	-0.091	-0.124	-0.233

Highly significant =*; Moderate significance=**; Significant=***

The correlation of Oxytocin with other parameters depicts positive correlation in both groups, but more so with control group. (Table 12)

Table 13: Baseline 1 & Baseline 2 of Oxidative stress, Prolactin & Oxytocin

Variables	BaseLine 1& 2	Group A- PS	Group B – PS
Oxidative stress B1& BL 2	0.969***	0.952***	0.981***
Prolactin(PRL) BL1 & BL2	-0.233	-0.220	-0.237
Oxytocin (OT)BL1 & BL 2	-0.098	-0.637**	-0.175

Highly significant =*; Moderate significance=**; Significant=*; PS – post scores**

Table 14: Oxytocin Bl 1 & BL2 – BP/HR/Mean Arterial Pressure(MAP)

Variables	BL1	GA PS	GB PS	BL 2	GA PS	GB PS
Presys1	-0.312*	-0.254	-0.382*	0.141	0.169	0.144
Post sys 1	--0.126	0.149	-0.268	0.071	-0.181	0.069
Post sys 2	-0.143	0.134	-0.293	0.170	0.003	0.144
Post sys 3	-0.049	0.004	-0.212	0.105	-0.033	-0.013
Pre Dias 1	0.081	-0.139	0.111	-0.106	-0.064	-0.131
Post dias 1	-0.011	-0.106	-0.045	0.003	0.142	-0.147
Post Dias 2	0.053	-0.215	0.025	0.062	0.114	-0.099
Post Dias 3	0.028	0.005	0.001	-0.097	-0.094	-0.209
Pre HR D1	0.222	0.470**	0.331	-0.104	-0.244	0.027
Post HR D1	0.244	0.318	0.325	0.003	-0.120	-0.003
Post HR D2	0.107	0.294	0.088	0.039	-0.138	0.066
Post HR D3	0.176	0.334	0.179	0.509	-0.185	-0.066
Pre MAP D1	-0.092	-0.094	0.158	0.284	0.315	0.181
Post MAP D1	0.112	-0.040	-0.137	0.030	0.059	-0.105
Post MAP D2	-0.059	-0.147	-0.131	0.123	0.099	-0.018
Post MAP D3	-0.015	0.005	-0.064	0.008	-0.077	-0.183

MAP- Mean arterial Pressure; BL- Base line; PS GA- post scores Group A; PS GB-post scores Group B

The data of oxytocin with Mean arterial pressure depicts a positive correlation with baseline 1 to Pre HR on D1 and no other significant correlation with other parameters.

Table 15: Prolactin BL 1 & BL2 – BP/HR/Mean Arterial Pressure

Variables	Bl 1	PS GA	PS GB	BL2	PS GA	PS GB
Presys1	-0.095	-0.268	-0.295	-0.275*	-0.057	-0.145
Post sys 1	0.119	0.073	-0.199	-0.132	-0.030	-0.139
Post sys 2	0.217	-0.055	-0.144	-0.144	0.197	-0.115
Post sys 3	0.128	0.129	0.038	-0.012	-0.106	-0.220
Pre Dias 1	-0.029	0.027	-0.127	-0.056	0.071	-0.169
Post dias 1	0.091	-0.162	0.026	-0.063	0.118	-0.084
Post Dias 2	0.258*	-0.318	0.094	-0.137	0.333	-0.129
Post Dias 3	0.684	0.162	-0.156	-0.021	-0.014	-0.219
Pre HR D1	-0.148	0.306	-0.091	0.110	-0.389*	0.289
Post HR D1	-0.024	0.122	-0.037	0.009	-0.358	0.285
Post HR D2	-0.028	0.329	-0.140	0.042	-0.404*	0.229
Post HR D3	-0.067	0.291-	0.014	0.068	-0.474*	-0.083
Pre MAP D1	0.068	0.057	-0.152	-0.104	0.167	-0.009
Post MAP D1	0.123	-0.116	-0.049	-0.105	0.092	-0.125
Post MAP D2	0.307*	-0.290	0.013	-0.175	0.343	-0.184
Post MAP D3	0.042	0.183	-0.122	-0.022	-0.036	-0.256

MAP: mean arterial pressure BL- Base line; PS GA- post scores Group A; PS GB-post scores Group B

There are no specific correlations with Prolactin with Both baseline 1 and two with other parameters with either of the groups

Table 16: Oxidative Stress BL1 & BL2 – BP/HR/Mean Arterial Pressure

Variables	BL 1	PS GA	PS GB	BL2	PS GA	PS GB
Presys1	0.240	0.267	0.223	0.259*	0.260	0.258
Post sys 1	0.065	-0.044	0.159	0.088	-0.003	0.194
Post sys 2	0.118	0.012	0.225	0.158	-0.127	0.251
Post sys 3	-0.085	-0.297	0.013	-0.067	-0.253	0.045
Pre Dias 1	-0.100	-0.179	-0.048	-0.090	-0.168	-0.039
Post dias 1	-0.086	-0.018	-0.121	-0.071	0.058	-0.135
Post Dias 2	0.119	0.132	0.131	0.123	0.163	0.118
Post Dias 3	-0.179	-0.304	-0.073	-0.171	0-.298	-0.056
Pre HR D1	-0.211	-0.311	-0.118	-0.258*	-0.378*	-0.143
Post HR D1	-0.163	-0.157	-0.177	-0.222	-0.250	-0.202
Post HR D2	-0.193	-0.410*	-0.028	-0.223	0.453*	-0.038
Post HR D3	-0.232	-0.344	-0.200	-0.253	-0.388*	-0.191
Pre-MAP D1	-0.038	-0.098	0.002	0.004	-0.036	0.030
Post MAP D1	0.047	-0.032	-0.049	-0.025	0.050	-0.048
Post MAP D2	0.149	0.118	0.243	0.169	0.177	0.244
Post MAP D3	-0.180	-0.355	-0.034	-0.168	-0.355	-0.034

MAP: Mean arterial Pressure ;BL- Base line; PS GA- post scores Group A; PS GB-post scores Group B

There are some mild correlations with baseline 1 and 2 of oxidative stress with Post HR day 2, with baseline 2 on the intervention groups of Pre HR D1, Post HR D 3

TWO WAY ANOVA

The Two-way ANOVA was performed for each of the Biomarkers of Oxytocin, Prolactin and Oxidative stress, BP Systolic, Diastolic, Heart Rate and Mean Arterial Pressure.

17. From the oxytocin tables, there was no significance found through the Two-way ANOVA between the groups, in terms of effect size as well as the variable groups means.

Table17a. Oxytocin

GROUPS	P1	P2	P3
Oxytocin	**Between Group**	**Effect Size Of Groups And Means**	**Variable Group Means**
BL GROUP A	0.635	0.659	0.659
BL GROUP B			

Table 17b. Oxytocin Descriptives					
Cases		**df**	**F**	**η^2**	**η^2_p**
Groups		1	0.659	0.001	0.001
TEST		3	0.659	0.011	0.011
Groups ✻ TEST		3	0.659	0.011	0.011
Residuals	0.94	172	0.293		

18. The prolactin scores with the data from the Two-way ANOVA depicts a positive moderate significance between the groups, a high significance with the effect size between the means of the groups as well as the variable group means

Table 18a. Prolactin

GROUPS	P1	P2	P3
Prolactin	**Between Group**	**Effect Size Of Groups And Means**	**Variable Group Means**
BL GROUP A	0.064	<0.001	<0.001
BL GROUP B			

Table 18 b. Prolactin Descriptives				
Cases	**df**	**F**	**η^2**	**η^2_p**
Groups	1	3.480	0.010	0.020
TEST	3	55.88	0.466	0.494
Groups ✻ TEST	3	6.226	0.052	0.098
Residuals	23115.678		172	134.39

19. From the oxidative stress tables, there was no significance found through the Two-way ANOVA between the groups, in terms of effect size as well as the variable groups' means.

Table 19a: Oxidative Stress

GROUPS	P1	P2	P3
Oxidative stress	**Between Group**	**Effect Size Of Groups And Means**	**Variable Group Means**
BL GROUP A	0.785	0.953	0.994
BL GROUP B			

Table 19b: Oxidative Stress Descriptives					
Cases		**df**	**F**	**η^2**	**η^2_p**
Groups		1	0.074	0.316	0.326
TEST		3	0.111	0.002	0.002
Groups ✻ TEST		3	0.026	0.507	0.517
Residuals	1844.434	172	10.723		

20. The Two-way ANOVA depicts a high significance in terms of the Data between groups, With the effects size if the groups and means as well as the variable group means.

Table 20a– BP Systolic

GROUPS	P1	P2	P3
Blood pressure Systolic	**Between Group**	**Effect Size Of Groups And Means**	**Variable Group Means**
BL GROUP A	<0.001	<0.001	<0.001
BL GROUP B			

Table 20 b: BP Systolic Descriptives				
Cases		**Df**	**F**	**η^2_p**
Groups		1	58.018	0.200
TEST		3	26.417	0.255
Groups ✻ TEST		3	8.273	0.097
Residuals	9937.50	232		42.834

21. The Two Way ANOVA for BP Diastolic, the data found moderate significance in terms of means between the group, the effect size of the groups and means while there is no significance in terms of the Variable group means

Table 21a- BP Diastolic

GROUPS	P1	P2	P3
Blood pressure Diastolic	**Between Group**	**Effect Size Of Groups And Means**	**Variable Group Means**
BL GROUP A	0.014	0.027	0.390
BL GROUP B			

Table 21b. BP Diastolic Descriptives				
Cases	**df**	**F**	**η^2**	**η^2_p**
Groups	1	6.119	0.024	0.026
TEST	3	3.127	0.037	0.039
Groups ✻ TEST	3	1.009	0.012	0.013
Residuals	23	79.447		

22. The Two-way ANOVA depicts a high significance in terms of the Data between groups, With the effects size if the groups & means and a moderate significance in the variable group means. The data depicts a high significance between the groups, in terms of the effect size between the groups and the means as well as the moderate level of statistical significance in Variable Group means

Table 22a: Mean Arterial Pressure (MAP)

GROUPS	P1	P2	P3
Mean Arterial Pressure	**Between Group**	**Effect Size Of Groups And Means**	**Variable Group Means**
BL GROUP A	<0.001	<0.001	0.015
BL GROUP B			

Table 22b: Mean Arterial Pressure Descriptives					
Cases		**df**	**F**	**η^2**	**η^2_p**
Groups		1	22.04	0.077	0.087
TEST		3	7.316	0.076	0.086
Groups ✻ TEST		3	3.58	0.037	0.044
Residuals	10179.198	232		43.876	

CHAPTER 6

Discussion

This study was conducted based on previous literature that showcased the dearth in studies in establishing the effect of music therapy on biomarkers, within the domains of pregnancy and lactation while major studies have been conducted on pain and anxiety in pregnancy and postpartum.[96] The current study was conducted to record the changes in prolactin and oxytocin levels in the light of using music therapy as an adjuvant intervention in association with standard medical care.

The age of the mother depicted a mean of 25 in both groups. Literature cites that the age of the mother possesses an effect on maternal health which could thus relate to issues concerned with pregnancy and the data is consistent with earlier evidence that between the ages of 20 and 35 is the right time for childbirth and breastfeeding. This is attributed to the maturity of the mother to cope in terms of physical strength, emotional ability to handle the pregnancy and take care of the child following delivery. This is consistent with studies conducted with similar populations.[110,111,112]

The educational background of the mothers was consistent with the age as well. The educational levels of the mothers were found to be at the graduate level majorly, bringing to light the aspects of being aware of taking care of themselves, their family and of pregnancy as well. The ability of the mothers to acquire knowledge as to how to understand their body and take care of their child and to make the right decisions in besides making the right decisions terms of breastfeeding and overall health of the child is dependent on education.[113,114]

In the Indian subcontinent, studies recording prolactin levels with classical Indian music are sparse. In our study has depicted the changes in prolactin with two baseline values and one post value. The first base line value is intended to comprehend the difference in childbirth, while the second baseline is to monitor the changes in contrast to the post results with reference to the intervention and control period. The results are quite interesting and at a glance in conjunction with what has been found in previous studies about the levels of PRL pre- and post-delivery. The mean values at the first baseline in both groups are 55.756 in the intervention group and 52.661 in the control. However, the second baseline scores depict an increase in

both groups with 68.30 and 75.71 in the treatment and control groups respectively, corresponding to a P value P=<0.001 post intervention at 72 hours.(Table 2 and fig 3) However, with reference to the significance in the control group post-delivery and prior to intervention is a phenomenon to be studied in further detail and with an enhanced sample size for studying causal relationship. However we cite that some Post partum fatigue might be one of the reasons to explain the paradox in our results, with reference to the documented increase in PRL levels in the control during the first 8 hours post-partum.[100] The paradox could also be explained based on age-related determinants of post-partum fatigue in primiparous women.[101] It is also possible that the ACTH- cortisol partnership could differentially alter PRL levels in the first few hours, following partum. This is explained based on complex pathways in the neuroendocrinology of lactation.[102]

It is interesting to note that there are minimal studies with the use of music as an intervention on PRL in healthcare settings and more so with the inherent nexus concerning pregnancy and lactation. This would perhaps be the first of a kind study with Indian classical Music in association with imagery pertaining to the effect on the lactating mothers, with reference to hormonal status, oxidative stress and breastfeeding satisfaction, experience.

The status if extracellular oxytocin with reference to music therapy was studied to delineate as to whether music therapy has a positive effect in improving the levels in various populations as per documented reports.[85,86] The first base line value was intended to understand the difference in oxytocin at the time of first stage of labor, while the second baseline was to monitor the changes in contrast to the post results pertaining to the intervention and control groups. The results can be seen with the mean values of three values from baseline, to baseline 2 and to post intervention. (Refer table 3 and fig 4). The role of music as an adjuvant intervention thus portrays a positive effect with reference to oxytocin levels, which is in agreement with earlier studies.[85,86] Hitherto, very few studies have specific mention on the use of music in any form with regard to oxytocin following delivery and during lactation and more so not many references on assessing the use of classical music extracellular samples. Earlier studies have found the increments in volume, lipid, total protein and albumin concentration of breast milk secretion with premature babies, recording the possible mechanism of increase in oxytocin.[33,34,35,36,103] However, there is no real time evidence to cite the effect of Indian classical music on primi mothers as well as the evaluation through serum(extracellular) samples. There are scientific evidences to

suggest that music has been found to enhance oxytocin levels and the mechanism is explained as well.[104,105,106]

Studies citing the effect of monitoring oxidative stress in lactation are few on comparison to the literature available for cortisol. Oxidative stress has been found to increase during the end of pregnancy and synonymous with a biochemical event, namely, lipid peroxidation, besides inhibiting antioxidant enzymes. Malondialdehyde (MDA) is one of the most frequently employed biomarkers of lipid peroxidation.[67] Oxidative stress impacts the baby from an early stage and has a longitudinal effect comprising a wide gamut including neurodevelopmental disorders, heart disease, pulmonary disorders, insulin resistance, hypertension, and vascular stroke[25] in preterm newborns.[72] Breast milk has been found to possess antioxidant properties, and we took cognizance of the fact in planning our study.[69,73-75]

The current study has recorded a significant reduction($p=<0.001$) in oxidative stress evaluated through the MDA with the significance noted with reference to three days and six music-based interventions. (**Table 4**) This could well be one of the few data available with this population with regard to oxidative stress. The results on oxidative stress in association with oxytocin depicted a negative correlation with respect to the control group (B). With prolactin, we did not find anything relevant other than a negative correlation in the base line. There is a positive correlation with both groups but more so with control group(B). However, the co-efficient were found to be moderate in significance. (**Table 4**)

The Maternal Breastfeeding Evaluation Scale (MBFES) is a scale of 30 questions with three subscales. The three subscales measure maternal needs and baby's growth. Subscale one is on maternal enjoyment and role attainment, and the questions pertain to the mother being comfortable with the process of breastfeeding and taking the role of a breastfeeding mother with ease. Subscale two pertains to the satisfaction and growth of the baby. Subscale three pertains to questions regarding maternal lifestyle and body image. **Fig 5** provides a visual depiction of the improvements found in the intervention group(A) in the main scale as well as the subscales in comparison to the Control Group(B) The third subscale comprises negative statements as compared to sub scales one and two. The results of this scale have provided the expected results from subscale 1 & 2 with a high significance of $p=<0.001$. However, the third subscale also shows significance between the two groups. The subscale connected with maternal lifestyle and body image depicted a

rise in the scores as well in the intervention group, showing that, the changes were also positive with a P value of 0.001.

Positive thoughts and emotions acquire a pivotal role and have been a point of discussion in lactating mother[107] and Music has been found to have a significant increase in breastfeeding satisfaction according to evidence based research.[108,109] However, there are one specific mention of the MBFES scale in connection with music intervention and more so within the Indian context.[110,111] The MBFES scale doesn't only evaluate the ability of satisfaction from the point of view of breastfeeding for the child, but also takes into holistic account, the comfort level of the mother and the body image that she may possess during and after child birth. This is frequently ignored in practice and also in research studies.

Enhancement in the ability of the mother as well as an increase in the comfort of the suckling infant provides a positive outcome in lactation and breastmilk secretion.[15] Listening to music could have a positive effect on the perception of the mother and the child which is consistent with the increase in the time of the feeds by the baby and the quality of feeding as well.[16] Our results are in compliance, but acquire special dimension since Indian classical music was used.

Maternal perception of breastmilk secretion is said to be an objective measure to understand the comfort of feeding,[16] which is similar to the results of this study with an increase in feeding duration, times of feeding and increase in the use of nappies signifying the breastfeeding pattern and increase evaluated through the UNICEF breastfeeding checklist.(**Table 5)** These suggest unequivocally the value of administering music as adjuvant therapeutic modality. Similar effects were found in an earlier study that had utilized preferred music in the Indian context[112] which is consistent with the results of study

The repeated measures ANOVA have provided a clear picture with reference to the systolic blood pressure between the groups with a gradual reduction of means through the three days post-delivery **(Fig 6).** The significant differences in diastolic ranges were found in the post scores with p=0.027 and post day 3 with p=0.05 when comparing the Intervention group(A) to Control(B). (**Fig 7**) The heart rate comparison between the intervention and control groups shows a positive significance with the post scores of day two and day three, P=0.002 and P=0.001 respectively. (**Fig 8**)

Mean arterial pressure (MAP) is the average pressure in the arteries during a cardiac cycle. In pregnancy post labour, it has been found to reduce or regulate BP which includes MAP more with mothers who breastfeed than those who don't. in our study. The analysis on mean arterial pressure was found to be positively significant in the post scores of day 1, and highly significant on days 2 and three (**Table 6 Fig 9**). This could explain the connection to the synonymous reduced BP Systolic and Diastolic as well as the feeding pattern evaluated with the UNICEF Breastfeeding checklist. The researcher was unable to find any specific literature with music interventions in terms of mean arterial pressure. The data analysis of this study may perhaps be one of the first ones to analyze MAP in lactating mothers

The literature review available on blood pressure and heart in pregnancy are found in antenatal mothers as well as in fetal cardiac behaviors. There are studies for delineating fetal heart rate post-delivery. However, a very insignificant number of studies have documented the mothers after delivery in this dimension. We can understand the idea that the mothers' physiological attributes might possess an effect in calming the child. However, the studies that have been conducted thus far have been on breastfeeding ability of the new mother and more so with premature babies and most significantly not many in normal births and full-term babies. This lacuna was identified prior to the current study and hence the data analysis was found to be quite interesting. However, the gradual changes in diastolic blood pressure were a new finding with the use of Music within a short duration of intervention period.

On the whole there is a trend towards an increase in Oxytocin and Prolactin levels as well as a proportionate reduction in oxidative stress based on the data analyzed and also with regard to the correlation of the main biomarkers with the rest of the variables of the study. The trend unequivocally points to a steady decrease in oxidative stress. The prolactin levels displayed a small increase in the second baseline of the data, but an increase following the MT Intervention in comparison to the control group. However, oxytocin showed a steady increase in the values in the intervention group in comparison to the control group. The levels of change might be further analyzed as to the ratio of change recorded. The study might further prompt the analysis of the effect of the changes in association among the ragas selected by the subjects.

CHAPTER 7

Novel Facts that have Emerged from the Study

1. Music as a non-invasive therapeutic modality could act as a modulator in the optimization levels of the endocrine markers, namely prolactin and oxytocin.
2. Indian classical music has been utilized in the Obstetrics and Gynecology setting, in close association with Guided Imagery. Thus, the Conventional Guided Imagery and Music(GIM)with inherent Western Classical Music as propounded by the Bonny method has been seamlessly introduced as an adapted version as Directed Music Imagery(DMI) with Indian classical music, in a one of a kind Scientific study.
3. The statistically significant increase found in Prolactin levels upon the administration of music has signaled the arrival of new information on the biomarkers of lactation. with oxidative stress being an additional entity
4. Six major rAgAs or musical modes in the Indian Classical genre were picked from the 72 melakarta modes (Main *rAgAs* , also known as janaka *rAgAs* and the script of the imagery was incorporated to the recordings administered to the subjects. This has created evidence with reference to the use of musical modes and imagery.
5. The study has underlined the utility of rAgAs or classical music(al) modes, in association with imagery as a part of music assisted relaxation, with respect to changes in oxytocin, prolactin and magnitude of oxidative stress in lactating mothers
6. This would represent one of the earliest studies to document the utility of Sampoorna ragas (musical modes possessing all the seven musical notes in the ascending and descending scales, namely arohana and avarohana respectively) as a tool of wellness, in conjunction with the imagery on mothers who had delivered normally and who were evaluated for PRL levels and magnitude of oxidative stress.
7. Indian classical music, in combination with Directed Music Imagery (an adapted MT techniques of GIM), besides alleviating oxidative stress could act as a modulator of endocrine of endocrine secretions considered vital for holistic health in the post-partum period, synchronizing with healthy breast feeding experience and practice as well as compliance with the established MBFES and UNICEF breastfeeding checklist

CHAPTER 8

Summary and Conclusion

The current study has provided a positive outcome with reference to the extracellular status of prolactin and oxytocin, subsequent to music-based intervention. The outcomes of the study have provided evidence pertaining to Oxidative stress as assessed through Malondialdehyde that shows a decrease within a short period of intervention in lactating primi mothers. The maternal perception of receptive music recorded through the MBFES and UNICEF breastfeeding checklist were found to be consistent with reference to improvement as well as the maternal breastfeeding satisfaction scale. The maternal breastfeeding satisfaction scale was found to be significant in all the three subscales with a pronounced significance observed in the third subscale, that denoted the body image of the lactating mothers as well.

The data on the hemodynamic parameters, namely heart rate and blood pressure on point to consistent improvement or changes as reported in the previous literature. The study could thus provide a positive objective outcome that could be extended towards the evaluation of other biomarkers of lactation, using music as an adjuvant receptive modality but within the clinical wards of obstetrics and gynecology department. This would perhaps be one of the few documented studies to evaluate Prolactin levels utilizing the services of a credentialed music therapist (Principal investigator) within an interdisciplinary setting at a tertiary hospital. However, further studies are warranted to comprehend the mechanism of the changes deciphered in this study. The spectrum of research could be also extended to alleviation of postpartum anxiety and depression, using cardinal biomarkers.

CHAPTER 9

Challenges Encountered and Limitations of the Study

1. The dropout rate proved to be one of the major challenges of the study. Keeping the dropout rate in mind, the sample size was essentially calculated with a 20 percent increase and despite that, the dropout rate was much higher than it was originally anticipated.

2. The study intrinsically had two major measures pertaining to quantitative determination of analytes, one prior to delivery and one post-delivery**.** The subjects for the study being those who had a normal vaginal delivery brought forth an inherent challenge, since the subjects who had undergone emergency C-section and those who were administered additional doses of Pitocin(oxytocin) than the usual dosage indicated had to be promptly excluded.

3. Another major challenge revolved around the selection of subjects with no comorbidities. This led to an enormous reduction and delay in recruiting the study subjects.

4. Follow-up sessions for the home-based intervention group posed additional challenges with some subjects who did not come for the visit at 45 days. However, utmost care was taken to ensure compliance.

5. One of the major obstacles that hampered the early completion of the study is attributed to the fact that study subjects in the music intervention group pulled out, midway through the study period of 45 days of assessment period.

CHAPTER 10

Scope for Future Studies

1. The study has provided an insight into the endocrine biomarkers, namely OT, PRL and another key player, namely oxidative stress, in the light of music as a non-invasive wellness tool in lactating mothers. To the best of our knowledge, our results would open newer vistas in the use of musical modes (Indian Classical), termed *rAgAs* or *rAgA* (singular), in obstetrics and gynecology.

2. Further studies with reference to music as a wellness tool could also be aimed at a holistic relationship that could be elicited from the perspectives of biochemical endocrinology, Obstetrics & Gynecology, Clinical nutrition, psychology, free radical biochemistry, and other thrust areas. Mention on future studies stems from the fact that music as a non-invasive tool could find utility in the mothers of very-low-birthweight (VLBW) infants, who suffer from problems associated with the establishment and maintenance of lactation.

3. Music in general and Indian Classical music in particular either in silos or in conjunction with other adjuvant modalities could be used in lactating mothers to monitor the comprehensive status of the total Antioxidant status (TAS) and the Total Oxidant status (TOS) as well as other important biochemical parameters including lactoferrin, bilirubin and protein bound sialic acid scores, besides the extracellular levels of pro- and anti-inflammatory cytokines, progesterone, estrogen, OT and PRL. This would enable research from the viewpoint of generating objective evidence in salutogenesis (wellness), wherein music could be used as a non-invasive adjuvant modality in regulating the qualitative and quantitative processes associated with breast milk secretion.

4. Future studies could also be aimed at several facets of maternal and infant health, keeping a view of the United Nations Sustainable Development Goal 3(UN SDG 3).

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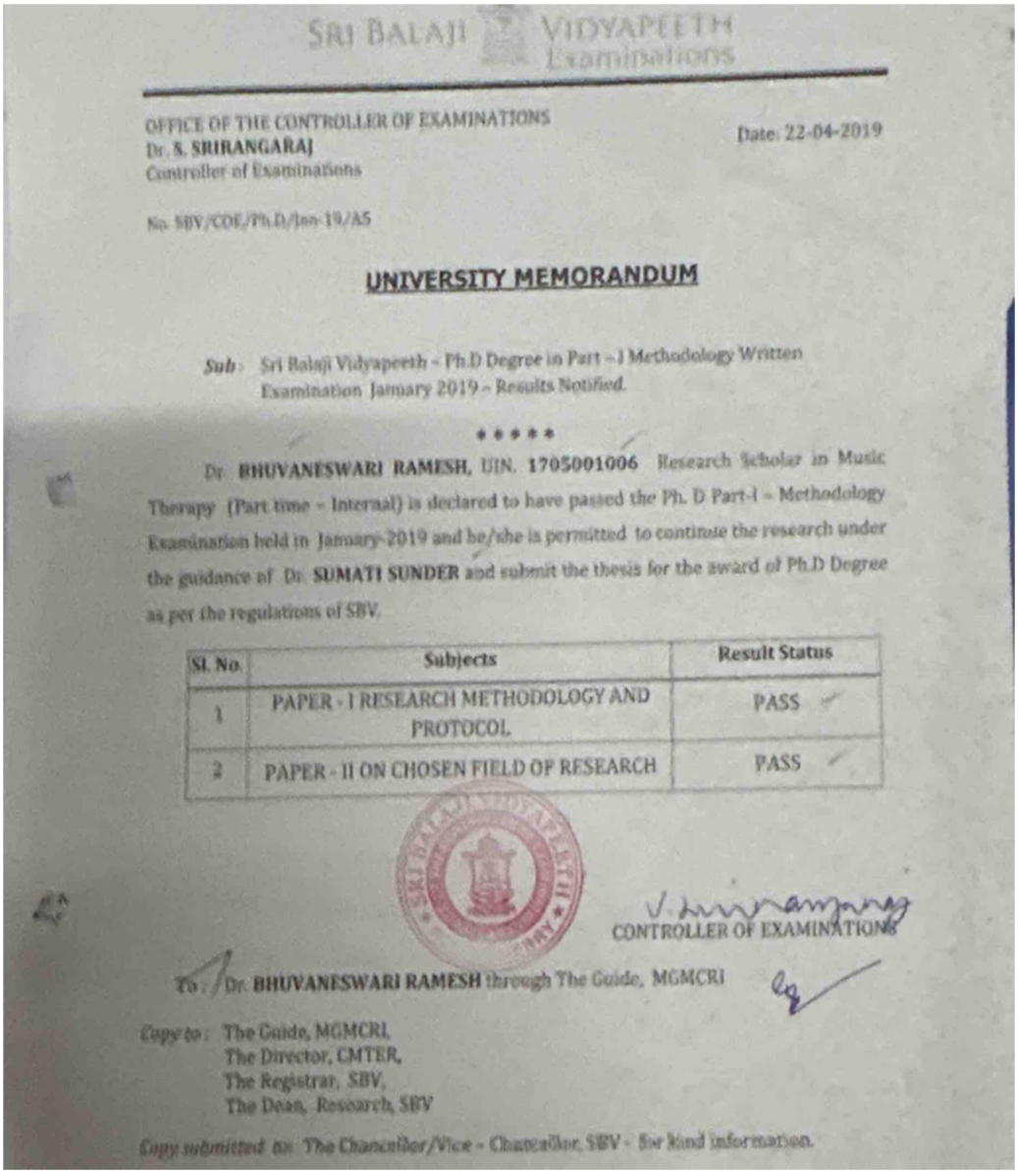
APPENDIX

1. RESULTS FOR QUALIFYING EXAMINATIONS-2019



SRI BALAJI VIDYAPEETH
Examinations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
Dr. S. SRIRANGARAJ
Controller of Examinations

Date: 22-04-2019

No. SBV/COE/Ph.D/Jan-19/A5

UNIVERSITY MEMORANDUM

Sub: Sri Balaji Vidyapeeth – Ph.D Degree in Part – I Methodology Written Examination January 2019 – Results Notified.

*****

Dr. **BHUVANESWARI RAMESH**, UIN. **1705001006** Research Scholar in Music Therapy (Part time – Internal) is declared to have passed the Ph. D Part-I – Methodology Examination held in January-2019 and he/she is permitted to continue the research under the guidance of Dr. **SUMATI SUNDER** and submit the thesis for the award of Ph.D Degree as per the regulations of SBV.

Sl. No.	Subjects	Result Status
1	PAPER - I RESEARCH METHODOLOGY AND PROTOCOL	PASS
2	PAPER - II ON CHOSEN FIELD OF RESEARCH	PASS

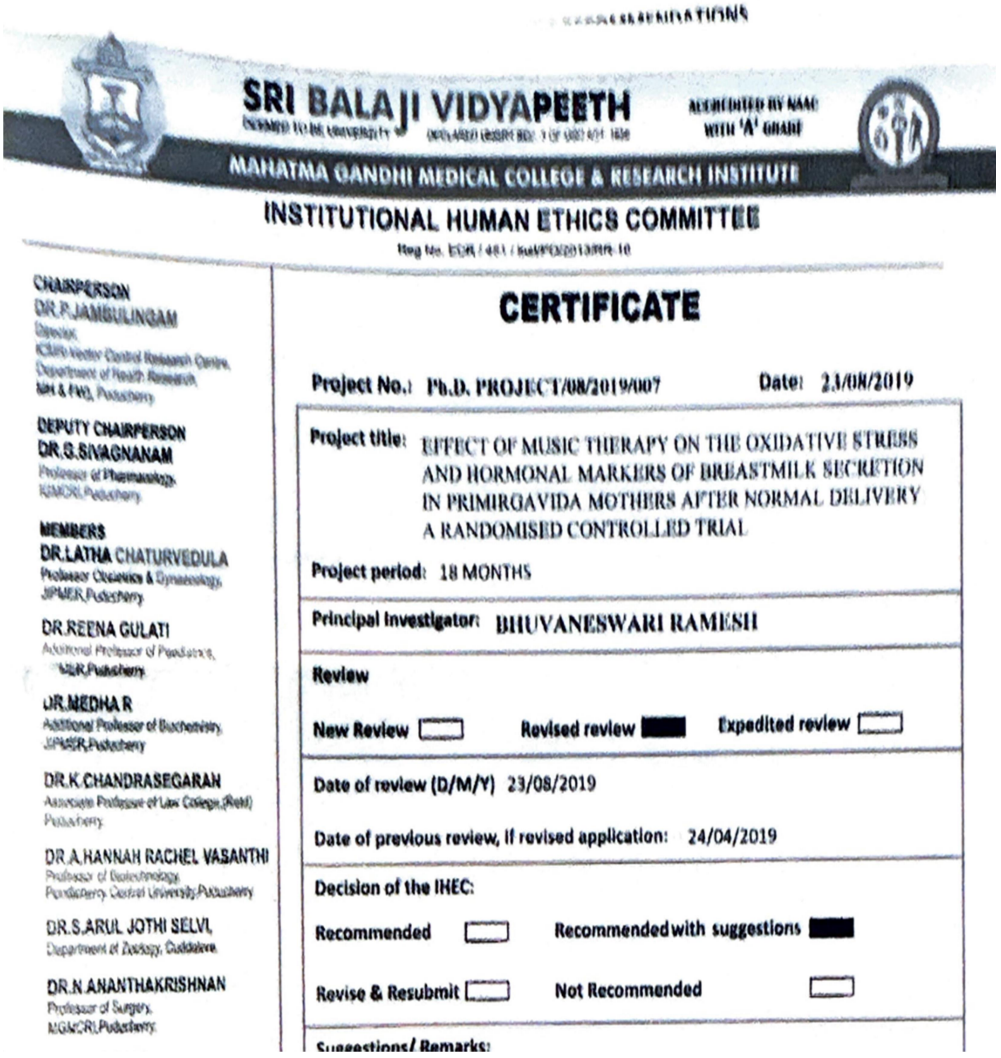
CONTROLLER OF EXAMINATIONS

To: Dr. **BHUVANESWARI RAMESH** through The Guide, MGMCRI

Copy to: The Guide, MGMCRI,
The Director, CMTER,
The Registrar, SBV,
The Dean, Research, SBV

Copy submitted to: The Chancellor/Vice – Chancellor, SBV – for kind information.

2. IHEC CERTIFICATE - 2019



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DR.N.ANANTHAKRISHNAN
Professor of Surgery,
MGMCRI,Puducherry.

CERTIFICATE

Project No.: Ph.D. PROJECT/08/2019/007 **Date:** 23/08/2019

Project title: EFFECT OF MUSIC THERAPY ON THE OXIDATIVE STRESS AND HORMONAL MARKERS OF BREASTMILK SECRETION IN PRIMIGRAVIDA MOTHERS AFTER NORMAL DELIVERY A RANDOMISED CONTROLLED TRIAL

Project period: 18 MONTHS

Principal Investigator: BHUVANESWARI RAMESH

Review

New Review ☐ **Revised review** ■ **Expedited review** ☐

Date of review (D/M/Y) 23/08/2019

Date of previous review, if revised application: 24/04/2019

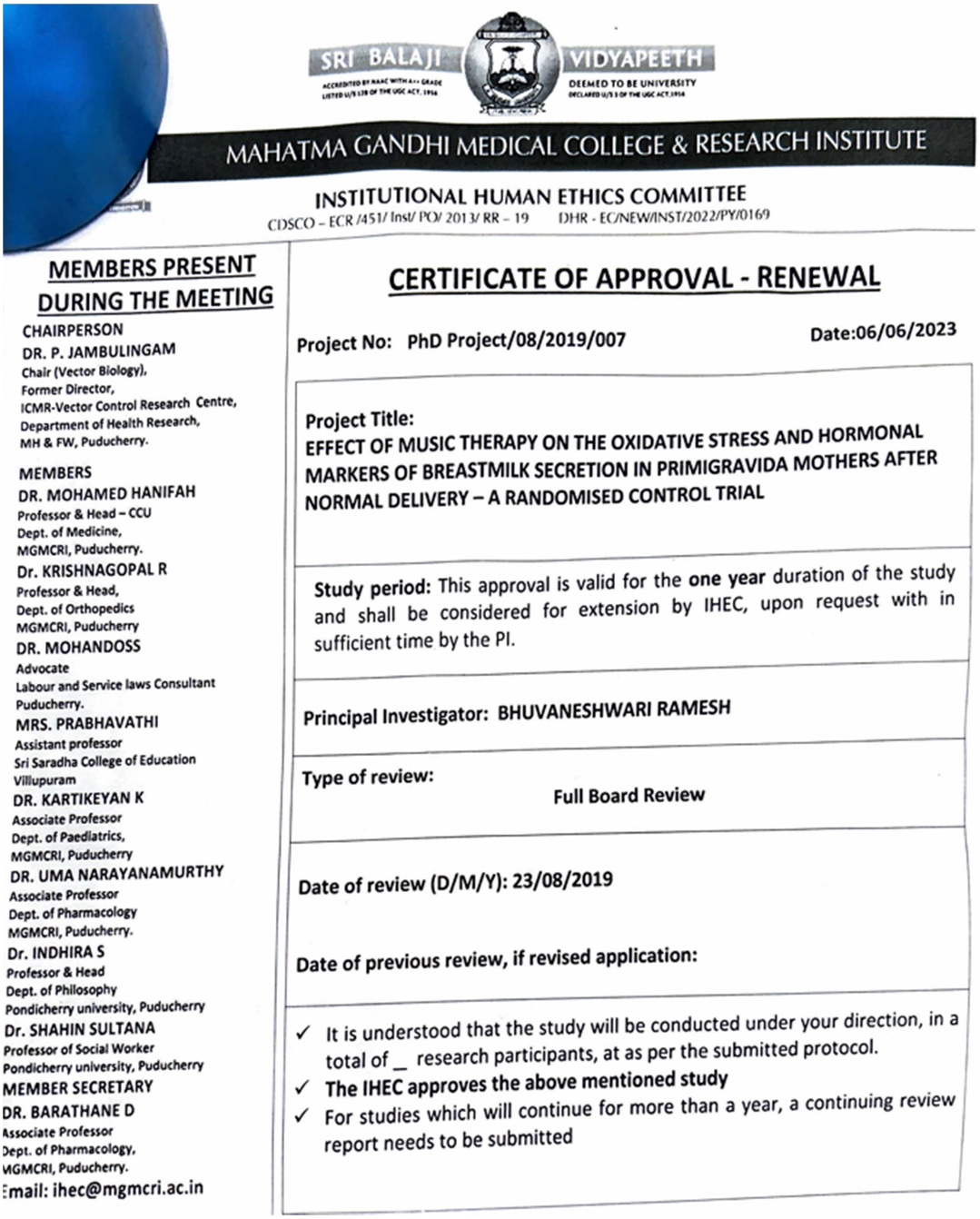
Decision of the IHEC:

Recommended ☐ **Recommended with suggestions** ■

Revise & Resubmit ☐ **Not Recommended** ☐

Suggestions/ Remarks:

3. IHEC EXTENSION CERTIFICATE-2023



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INSTITUTIONAL HUMAN ETHICS COMMITTEE
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MEMBERS PRESENT DURING THE MEETING

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Former Director,
ICMR-Vector Control Research Centre,
Department of Health Research,
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CERTIFICATE OF APPROVAL - RENEWAL

Project No: PhD Project/08/2019/007 **Date:06/06/2023**

Project Title:
EFFECT OF MUSIC THERAPY ON THE OXIDATIVE STRESS AND HORMONAL MARKERS OF BREASTMILK SECRETION IN PRIMIGRAVIDA MOTHERS AFTER NORMAL DELIVERY – A RANDOMISED CONTROL TRIAL

Study period: This approval is valid for the **one year** duration of the study and shall be considered for extension by IHEC, upon request with in sufficient time by the PI.

Principal Investigator: BHUVANESHWARI RAMESH

Type of review: **Full Board Review**

Date of review (D/M/Y): 23/08/2019

Date of previous review, if revised application:

- ✓ It is understood that the study will be conducted under your direction, in a total of _ research participants, at as per the submitted protocol.
- ✓ **The IHEC approves the above mentioned study**
- ✓ For studies which will continue for more than a year, a continuing review report needs to be submitted

4. World Federation Of Music Therapy Recognition

Our Leadership

WFMT Council 2023 - 2026

WFMT is governed by a group of elected Officers and Commissioners. Additionally, eight Regional Liaisons are appointed by the Council to represent the WFMT within defined regions of the world.

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5. PUBLICATION 1- 2024

RESEARCH
O&G Forum 2024; 34 – 2s: 68 - 73

EVALUATION OF POTENTIAL LACTOGENIC EFFECT OF RECEPTIVE MUSIC THERAPY USING INDIAN CLASSICAL MUSIC IN PRIMIPARAS WOMEN- A CASE CONTROL STUDY

Bhuvaneswari Ramesh [1], A R Srinivasan [2*], Dr.Agiesh Kumar [3], Prof Seetesh Ghose [4]
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Abstract
Background: Music therapy in recent years has been widely acclaimed as a non-invasive therapeutic modality for various disorders as well as a strategic tool in the promulgation of salutogenesis or wellness. Among the four major types of music therapy in vogue, receptive music therapy has been acquiring special significance as a tool of wellness in bestowing a relaxing and calming experience. However, very few reports, based on evidence generated data are available from India on the use of Indian Classical Music rAgas or musical modes in receptive music therapy, as applied to obstetrics-gynecology setting related to lactation management.
Methods: The Case control trial was carried out on 60 primipara mothers who had a normal delivery at a tertiary health care set up endowed with a school of music therapy. Blood samples were collected once each, prior to delivery, post -delivery and following 72 hours. Credentialed music was administered, using six sampUrNa rAgAs (musical modes having all the seven notes) twice daily for 30 minutes and fortified by an imagery script to facilitate bonding with the child. The study received the approbation of the competent authority. Biochemical estimation was carried out using ELISA kits. Appropriate statistical tools and stringent quality control in the laboratory were ensured.
Results: The study evaluated the changes in prolactin levels in immediate post partum women and the maternal perception of breastfeeding was also administered and analysed with the UNICEF Breastfeeding checklist. The results revealed positive improvement in prolactin levels in the Music therapy group in comparison to the control group. Some of the items of the checklist which included no of feeds per day. Time duration of each feed, comfort of the mother during breastfeeding and no of nappies changed during a day was found to be on a improvement over the control group.
Conclusion: Music therapy as a receptive method can be used in clinical areas where feasibility of complete silence may not be possible. The results of this study has shown that music therapy can be useful in lactating mothers with the increase biomarkers of hormones in lactating mothers. The maternal perception has also been positive towards the use of music therapy at the immediate postpartum period. The future implications may be directed towards other areas of stress, postpartum depression among others.
Keyword: postpartum, lactation, therapy, music, prolactin.

INTRODUCTION

Lactation is an important component for both mother and child.[1] Breastfeeding the child by the mother has proven effective on the child for enabling all round growth as well as for conferring long term health.[2] Besides, breastfeeding the child has also been a major determinant in maternal-infant bonding and the more a mother breastfeeds, the better would be the lactation [3]

Among the important factors of breastmilk secretion is Prolactin (PRL), also referred to as the lactogenic hormone. PRL is responsible for milk production, and suckling by the baby is the major stimulus for the mammary glands to produce milk during the process of lactation. PRL elicits the desired response by inhibiting dopamine and enhances the endogenous opioids considered essential for lactation. It must however be said that the hormones, namely Estrogen and Progesterone secreted from

6. PUBLICATION 2 - 2022

Full-Length Article

Impact of music therapy and the influence of Indian classical music on the extracellular status of endocrine markers in pregnant women: *A review.*

Bhuvaneswari Ramesh [1], A R Srinivasan[2]

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[2]*Mahatma Gandhi Medical College & Research Institute(MGMCRI), Sri Balaji Vidyapeeth (SBV), Bahour, India*

Abstract

Pregnancy and childbirth are regarded as unique experiences bestowed upon women. Pregnancy is a vulnerable stage that is virtually synonymous with constant changes and upheaval in the state of mind and body occurring over the gestation period. The variegated emotions that a first-time mother experiences is superimposed with anxiety, excitement, and happiness as well as accompanying fears of labor and childbirth. Each trimester brings along with it a wide gamut of changes in the mothers' physical, biological & psychological states along with the ability to cope with the weight of the newborn child. Not only does the mother possess her own body and mind to take care of, but she also has to receive the constant advice and recommendations from family and well-wishers on topics related to pregnancy, childbirth and post-partum experiences. This acquires special relevance in the Indian cultural context where conservative practices are still very much in vogue, despite various advancements in science and improved literacy rate. This review will provide available literature on stress and the endocrine markers during pregnancy. With a focus on the use of music, evidence on the effects of music and uses of music therapy, the review would aim to provide insights into the future implications of its potency in pregnancy.

Keywords: *pregnancy, Lactation, music therapy, endocrine markers, labor & child brith, postpartum, Biological, psychological, stress, oxytocin, prolactin, oxidative stress, stress markers, classical music*

Multilingual abstract | **mmd.iammonline.com**

Introduction

Pregnancy and the need for stress reduction

A stressful gestational period has been found to increase pregnancy failure, morbidity and mortality in mother and child. It has been found that depression during the third trimester can influence breastfeeding outcomes. There is striking evidence that point to rising levels of inflammation markers during gestation which can contribute to the risk of perinatal mood disorders.[1] Women go through extreme stress and anxiety during pregnancy and post labour. Perinatal stress can lead to depression and even psychosis if not addressed in time.[2] There is risk of physical health of the mother when stress suppresses the immune system, causing high risk pregnancy and subsequently having a negative effect on fetal development. This leads to hospitalization or bed-rest through pregnancy affecting the APGAR scores and may further warrant the need for hospitalization for the infant post labor in the neonatal intensive care unit (NICU) leading to long term developmental, emotional and physical health complication.[2,3]

PRODUCTION NOTES: Address correspondence to:

A R Srinivasan, E-mail: raghavan.dryars2000@gmail.com | COI statement: The authors declared that no financial support was given for the writing of this article. The authors have no conflict of interest to declare.

In a study by Hodgson et al., it was convincingly demonstrated that exposure to physiological mechanisms of maternal stress during the fetal period could influence regulation of stress, immunological maturation, pain perception, and cognition in the mother.[4] Field et al., first deciphered that the infants of mothers with high levels of stress and anxiety had low dopamine and serotonin levels, greater right frontal EEG activation and lower vagal tone which causes the inability to regulate heartbeat.[5] In yet another later study by Field, infants of mothers with depression during the prenatal period were shown to likely sleep less and were found to be agitated and crying.[6] Furthermore, sucking by infants has been found to reduce the cortisol levels in breastfeeding mothers.[7] A study found that during pregnancy, changes in cortisol & Leptin Index were found to be a response to the Hypothalamus Pituitary Adrenal (HPA) axis & Autonomic Nervous System (ANS) activity.

Stress and its ramifications

Stress has been found to be one of the most conspicuous pre-morbid factors that acts as a nexus between various risks attached and several chronic diseases. Stress affects us physically and psychologically which might possess long term effects. Chronic stress influences the cardiovascular, the neuroendocrine, and the central nervous systems.

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Evaluating the effect of music therapy on the establishment of lactogenesis and maternal breastfeeding satisfaction levels

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Abstract
Background: Establishment of lactogenesis is an important determinant for a successful breastfeeding journey of first-time mothers. Breastfeeding is essential for provision of immunity and neurodevelopment. Primigravids commonly encounter issues with the initiation of lactation process. Music has been documented to have an impact on reducing anxiety, stress as well as pain perception during labour thereby benefiting lactating mothers. This current study had evaluated the effect of music therapy aiding on process of lactogenesis and breastfeeding in primigravids
Objectives: To evaluate the effect of active music listening and singing lullabies on the establishment of lactogenesis and maternal breastfeeding satisfaction in new mothers.
Methods: This is an exploratory randomized controlled trial with primigravids (n=62) randomized and allocated into two groups i.e. (music therapy/group A; n=33) and (control group/ group B; n=29) respectively. Music therapy intervention was provided to group A, while standard medical care was commonly given to both groups. The UNICEF breast feeding checklist and Maternal Breast-Feeding Evaluation Scale (MBFES) was used to evaluate initiation of lactation time and maternal breastfeeding satisfaction levels respectively.
Results: There was statistically significant improvement in the initiation of lactation time, time of each feed and maternal breastfeeding satisfaction levels with a steady rise in time of each feed in music therapy group. There was also a significant difference in increase in time of feeds between the music therapy and control groups.
Conclusion: Music therapy may be helpful as an effective coping strategy for first-time mothers and help them in establishing lactogenesis. Music therapy may also be helpful in enhancing the maternal breast-feeding satisfaction levels.

Keywords: anxiety, breastfeeding, Indian music, lactation, lactogenesis, maternal satisfaction, music therapy

1. Introduction
United Nations Children's Fund (UNICEF) defines the breast milk as the baby's "first immunization' and highly beneficial to child's overall heath. It is an established fact that breastfeeding for the first six months and slowly adding safe nutritive diet provides the child with necessary health [1]. Establishing lactogenesis can be delayed due to reasons like maternal or fetal stress associated with the breastfeeding for the first time and the infant's suckling ability [2, 3]. Literature has clearly listed on some modifiable factors that influence early lactation process inclusive of duration of labor, medication during labor, delivery mode, caesarean birth, overweight mothers stressful labor and delivery, emergency and psychosocial stress or pain due to childbirth which are documented risks for early initiation of lactation [4, 5].
Prolonged labor and stress can often lead to an emergency caesarean which may impact the child's ability to suckle and may result in incessant crying and irritability.[6] Prolonged labor influences oxygen levels of the baby, transient cardiac arrhythmias and amniotic fluid contamination which causes distress and affects baby's growth [7].
Music therapy has been recorded in various studies for its relaxing properties and its effects on pain perception, anxiety, stress in different stages of labor [8]. Also, music has been observed to calm down mothers after delivery [9]. Music prior to breastfeeding had been shown to reduce anxiety of mothers and also increase the milk volume and the suckling of the newborn [90].
However, no studies have been cited that have used music therapy to record the maternal satisfaction with breastfeeding, onset of lactation time and the effects of music on long term basis for the improvement of breast-feeding practices, which are primary objectives to be evaluated in our study.

2. Materials and methods
2.1 Study Design
We employed a randomized controlled trial design (RCT) and conducted this study in a tertiary care teaching hospital

8. **PATIENT INFORMATION SHEET**

No:

MRD: Date**:**

Group: Control/Music

Name: Age:

Education: Type of Labor:
SPOL/Induced

Telephone: Husband/ parents/ Subject: Delivery: Normal/LSCS

UNICEF checklist - After delivery

Day1

1. No of feeds per day (Times) More than 8/less than 8
2. Time taken to feed (Minutes) 5/10/15/20/25/30/25/40
3. Skin color Normal/ yellow
4. Feeding Calm and relaxed/ Refusing to drink
5. Nappies Wet and heavy/ Dry and light
6. Breast feeding and pinched breasts Comfortable/ Painful or flat
7. Swallowing sounds (after 3rd day) Able to hear swallowing by baby/ Unable to hear swallowing by baby/ need to use external feeds

Day 2

1. No of feeds per day(Times) More than 8/less than 8
2. Time taken to feed(Mins) 5/10/15/20/25/30/25/40
3. Skin colour Normal/ yellow
4. Feeding calm and relaxed/ refusing to drink
5. Nappies Wet and heavy/ Dry and light

6. Breast feeding comfortable/ Painful or flat and pinched breasts

7. Swallowing sounds (after 3rd day) Able to hear swallowing by baby/ Unable to hear swallowing by baby/ need to use external feeds

Day3

1. No of feeds per day(Times) More than 8/less than 8

2. Time taken to feed(Mins) 5/10/15/20/25/30/25/40

3. Skin colour Normal/ yellow

4. Feeding calm and relaxed/ refusing to drink

5. Nappies Wet and heavy/ Dry and light

6. Breast feeding comfortable/ Painful or flat and pinched breasts

7. Swallowing sounds (after 3rd day) Able to hear swallowing by baby/ Unable to hear swallowing by baby/ need to use external feeds

Hormonal Markers

a. Level of Lipid Peroxidation (Oxidative stress)

1. **2.** **3.**

b. Level of Oxytocin1 : level of oxytocin 2:

c. Level of Prolactin1 : level of Prolactin 2:

9. MATERNAL BREASTFEEDING EVALUATION SCALE

Appendix 1. Maternal Breastfeeding Evaluation Scale (MBFES) *

If you breastfed more than one baby, base your answers on the most recent experience. Consider the overall breastfeeding experience, and please do not skip any questions.

Indicate your agreement or disagreement with each statement by circling the best answer:

SD = strongly disagree
D = disagree
N = no opinion or unsure
A = agree
SA = strongly agree

	Strongly Disagree				Strongly Agree
1. With breastfeeding I felt a sense of inner contentment.	SD	D	N	A	SA
2. Breastfeeding was a special time with my baby.	SD	D	N	A	SA
3. My baby wasn't interested in breastfeeding.	SD	D	N	A	SA
4. My baby loved to nurse.	SD	D	N	A	SA
5. It was a burden being my baby's main source of food.	SD	D	N	A	SA
6. I felt extremely close to my baby when I breastfed.	SD	D	N	A	SA
7. My baby was an eager breastfeeder.	SD	D	N	A	SA
8. Breastfeeding was physically draining.	SD	D	N	A	SA
9. It was important to me to be able to nurse.	SD	D	N	A	SA
10. While breastfeeding, my baby's growth was excellent.	SD	D	N	A	SA
11. My baby and I worked together to make breastfeeding go smoothly.	SD	D	N	A	SA
12. Breastfeeding was a very nurturing, maternal experience.	SD	D	N	A	SA
13. While breastfeeding, I felt self-conscious about my body.	SD	D	N	A	SA
14. With breastfeeding, I felt too tied down all the time.	SD	D	N	A	SA
15. While breastfeeding, I worried about my baby gaining enough weight.	SD	D	N	A	SA
16. Breastfeeding was soothing when my baby was upset or crying.	SD	D	N	A	SA
17. Breastfeeding was like a high of sorts.	SD	D	N	A	SA
18. The fact that I could produce the food to feed my own baby was very satisfying.	SD	D	N	A	SA
19. In the beginning, my baby had trouble breastfeeding.	SD	D	N	A	SA
20. Breastfeeding made me feel like a good mother.	SD	D	N	A	SA
21. I really enjoyed nursing.	SD	D	N	A	SA
22. While breastfeeding, I was anxious to have my body back.	SD	D	N	A	SA
23. Breastfeeding made me feel more confident as a mother.	SD	D	N	A	SA
24. My baby gained weight really well with breastmilk.	SD	D	N	A	SA
25. Breastfeeding made my baby feel more secure.	SD	D	N	A	SA
26. I could easily fit my baby's breastfeeding with my other activities.	SD	D	N	A	SA
27. Breastfeeding made me feel like a cow.	SD	D	N	A	SA
28. My baby did not relax while nursing.	SD	D	N	A	SA
29. Breastfeeding was emotionally draining.	SD	D	N	A	SA
30. Breastfeeding felt wonderful to me.	SD	D	N	A	SA

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10. Imagery Script – Tamil

இந்த நிலையில இப்போ உங்க குழந்தய கையில் a புடிச்சிருக்க மாறி நெனச்சுக்கோங்க ...உங்க குழந்தைய புடிக்கிறப்போ எப்படி இருக்கும் னு யோசிச்சு பாருங்க ....உங்க கொழந்த தூங்குதா?..... அவங்க முகம் எவ்ளோ நிம்மதிய ஒரு த்ரிப்திய இற்கு னு பாருங்க ...கொழந்தை கிட்ட பேசறதா நெனச்சுக்கோங்க .... நீ எனக்கு வெலை மதிப்பு இல்லாத ஒரு பரிசு ...கடவுளுக்கு நன்றி இந்த பரிசு காக ..... நா உன்ன நல படியா பாத்துக்குவேன் , என்னாலே முடிஞ்ச வர பாத்துக்குவேன் ..... நீ நல்ல படியா வாழ என்ன லாம் பண்ணணுமோ எல்லாம் பண்ணுவேன் ... இப்போ நீங்க உங்க கொழந்தைக்கு பால் குடுக்கிற மாறி நெனச்சுகோங்க ...பால் நல்லா சொரக்கர்த உணருங்க .....இசை கேட்டுட்டே உங்க கொழந்தை கு பால் குடுக்கறதா நெனச்சுக்கோங்க .... உங்க மனசுல இருக்கும் கவலை பயம் எல்லாம் மறைஞ்சு போறதா உணருங்க ..... எப்படிடி உங்க கொழந்தை தூங்கும் னு நெனச்சு பாருங்க ... ஒரு நுமதியான தூக்கம் .....உங்க கொழந்த உங்க கைல எப்படி அழகா எந்த கவலையும் கஷ்டமும் இல்லாம தூங்குது னு பாருங்க ....உங்க குழந்தை உங்கள முழுசா நம்பி இருக்கு ..... உங்க குழந்தைக்கு பால் குடுத்து .. மெதுவா அசஞ்சு பாட்டு பாடி அத தூங்க வைக்றத நெனச்சி பாருங்க ...உங்க கொழந்த கண்ணை மூடி .....அதோட குட்டி கைல உங்க சுண்டு விரலை புடிச்சி ....உங்கள தொட்டு நிம்மதியா இரக்கர்த பாருங்க .....உங்க கொழந்த இப்போ நல்லா தூங்குது .. மெதுவா அவங்கள தொட்டில் ல போடுங்க .....இதே நிலைல இருந்து கொஞ்சம் நேரம் நிம்மதியா இசை கேளுங்க .. மெதுவா மூச்சு எடுத்து விடுங்க

Music 10 mins

Conclusion

கொஞ்சம் கொஞ்சமா இசை நிக்க போது ... நீங்க இந்த நிலை லேர்ந்து வர வேண்டிய நேரம் வந்துருச்சு ... ஞாபகத்துல வெச்சுக்கோங்க .. இந்த நிம்மதியான நிலைக்கு நீங்க எப்போ வேணாலும் வரலாம் .. உங்க கை கால் விரல்களை மெதுவா அசைக்க ஆரம்பீங்க ... உங்குளுக்கு எப்போ தோணுதோ அப்போ மெதுவா உங்க கண்கள திறந்து .. ஒரு பக்கமா திரும்பி எழ்ந்துக்கோங்க

11. CERTIFICATION FOR TRAINING IN ASSESSMENT OF PRACTICAL ASPECTS OF ELISA AND WESTERN BLOT

SRI BALAJI VIDYAPEETH
DEEMED TO BE UNIVERSITY

CENTRAL INTER-DISCIPLINARY RESEARCH FACILITY
A Constituent Unit of Sri Balaji Vidyapeeth (SBV)
Deemed to be University,
Puducherry

CERTIFICATE COURSE IN INTRODUCTION ON BASICS AND PRACTICAL ASPECTS OF ELISA AND WESTERN BLOT

This is to certify that
Mr./ Mrs./Ms. /Dr. **Mrs. Bhuvaneswari Ramesh**
has successfully completed the Course in Introduction on Basics and Practical Aspects of Elisa and Western Blot with TWO *credits, conducted by Central Inter-Disciplinary Research Facility (CIDRF), Sri Balaji Vidyapeeth, Deemed-to-be University, Puducherry, from* 8th November *to* 10th November *, 2019.*

Dr. Agiesh Kumar B.
Course Co-ordinator

Dr. Veni Subramanyam
Course Co-ordinator

Dr. Balanehru Subramanian
Director, CIDRF, SBV

12. CERTICATE FOR THESIS WRITING- 2020

SRI BALAJI VIDYAPEETH
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DEEMED TO BE UNIVERSITY
DECLARED U/S 3 OF THE UGC ACT, 1956

Certificate of Participation

SBV Credit Points 10

This is to certify that
Dr./Mr./Ms. **Bhuvaneswari Ramesh**
has participated online at National Workshop on "Thesis Writing Workshop" for Ph.D Scholars Organized by Deanery Research, Sri Balaji Vidyapeeth(SBV), Puducherry held on 16th & 17th October, 2020

Dr. G. Ezhumalai,
Co-ordinator

Dr. Selvaraj Stephen
Dean Research(i/c), SBV

Prof. Subhash Chandra Parija
Vice Chancellor, SBV

13. CERTIFATE ON PUBLICATION ETHICS- 2023

SWAYAM ONLINE COURSE CERTIFICATION

This Certificate is awarded to

Bhuvaneswari Ramesh

for successfully completing the 2 credit course

Research and Publication Ethics (RPE)

with a consolidated score of 64% marks

in the proctored examination held on 01.12.2023

offered by ***Dr. Anirban Ghosh*** *of*

Netaji Subhas Open University, Kolkata

Roll No:TN01010024

Prof. Uma Kanjilal
National Coordinator
Indira Gandhi National Open University, New Delhi

Issued On: 25-12-2023

Dr. Ashit Baran Aich
Registrar(Acting)
Netaji Subhas Open University, Kolkata

To validate and check scores: https://swayam.gov.in/

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14. PRESENTATION OF THESIS TOPIC IN INTERNATIONAL CONFERENCE

International conference & Workshop on

"Exploring the Indian Cultural Ethos through Yoga, Natyam, Sangeetam & Samskrutam"

during the

6th Decennial Meet of Vishwa Yoga Samaj

(Yoga Jivana Satsanga)

CERTIFICATE

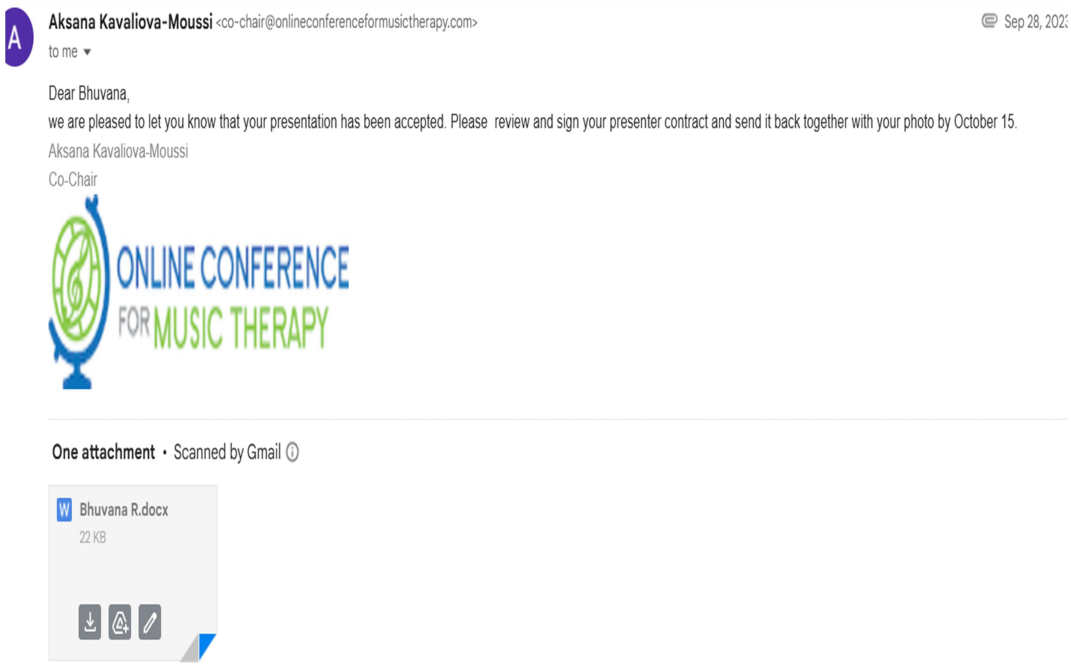
of Honour

GITANANDA YOGA™

This is to certify that Mr / Ms / Dr .....Bhuvaneswari Ramesh..... has participated in the **Paper Presentation** and presented a paper on the topic..Deep Breathing ..... Humming and Chanting ..... during Labour and Episiotomy Repair ..... ~~and secured~~ ..... prize in the **International Conference & Workshop** held on 16th September 2023 at ICYER @ Ananda Ashram, Pondicherry as part of the **6th Decennial Meet of Vishwa Yoga Samaj** conducted from 8th to 17th of September 2023.

Yogacharya, Kalaimamani
Dr. Ananda Balayogi Bhavanani
Chairman, ICYER & YOGNAT

15. ACCEPTANCE MAIL- PRESENTATION ON PRESENTATION OF THESIS TOPIC AT THE ONLINE CONFERENCE OF MUSIC THERAPY -2024



Aksana Kavaliova-Moussi <co-chair@onlineconferenceformusictherapy.com> Sep 28, 202

to me

Dear Bhuvana,

we are pleased to let you know that your presentation has been accepted. Please review and sign your presenter contract and send it back together with your photo by October 15.

Aksana Kavaliova-Moussi

Co-Chair

ONLINE CONFERENCE FOR MUSIC THERAPY

One attachment • Scanned by Gmail

Bhuvana R.docx

22 KB